TE - Sem-VII (R-2007) Mech. - Hydraulic Machinery
(old)

Hours: 03   Q. P. Code : 599900   23/11/11

Marks: 100

Note : 1. Question number 1 is **compulsory**
2. Solve any **FOUR** questions from remaining **SIX** questions
3. **Assume** suitable data if required.
4. Assumptions made should be clearly stated.

Q.1 (a) Differentiate between impulse and reaction hydraulic turbines.   05

(b) Differentiate between centrifugal and reciprocating pump.   05

(c) What are the advantages of Hydroelectric power plant over other types of   05
power plant?

(d) What is the function of air vessel in reciprocating pump?   05

Q.2 (a) A single jet Pelton wheel runs at 300 r. p. m. under a head of 510 m. The jet   12
diameter is 200 mm, its deflection inside the bucket is 165° and its relative
velocity is reduced by 15 % due to friction. Take mechanical losses = 3 %,
Coefficient of velocity = 0.98, speed ratio = 0.46

Determine:-

i) Water power
ii) Resultant force on the bucket
i) Overall efficiency

(b) Draw a general layout of a hydroelectric power plant using an impulse   08
turbine and explain the following terms:
i) Gross head   ii) Net head   iii) Hydraulic efficiency
iv) Mechanical efficiency   v) Overall efficiency

Q.3 (a) A reaction turbine works at 450 r. p.m. under a head of 120 m. Its diameter   12
at inlet is 1.2 m and the flow area is 0.4 m². The angles made by absolute
and relative velocities at inlet are 20° and 60° respectively with tangential
velocity. Determine:-
i) The volume flow rate
ii) The power developed
iii) Hydraulic efficiency.

(b) What is NPSH? What is the difference NPSH available and NPSH required?   08

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Q.4 (a) Explain briefly, with neat sketches the various types of casing used in the centrifugal pump.   08

(b) Describe the governing mechanism of reaction turbine with a neat sketch.   06

(c) What are multistage pumps? Explain it with neat sketches.   06

Q.5 (a) A centrifugal pump lifts water under a static head of 36 m of water of which 4 m is suction lift, The suction and delivery pipes are both 150 mm in diameter. The head loss in suction pipe is 1.8 m and in delivery pipe 7 m. The impeller is 380 mm in diameter and 25 mm wide at mouth and revolves at 1200 rpm. The exit blade angle is $35°$ and manometric efficiency of the pump is 82%. Plot velocity triangle at inlet and outlet tip and determine: 14

   (i) The discharge through the pump.

   (ii) The pressure at the suction side.

   (iii) The pressure at delivery side.

(b) A 1/5 scale turbine model is tested under a head of 15 m. The actual turbine will work under head of 30 m and speed of 450 m. If model develops 100 Kw of power using 1.1 m^3/s of water then calculate: 06

   i) Speed of the model,   ii) Power developed by prototype

Q.6 (a) A single acting reciprocating pump has a diameter (piston) of 150 mm and stroke length 350 mm. The centre of the pump is 3.5 m above the water surface in the sump and 22 m below the delivery water level. Both the suction and delivery pipes have the same diameter of 100 mm and are 5 m and 30 m long respectively. If the pump is working at 30 rpm, Determine:-   12

   i) The pressure heads on the piston at the beginning, middle and end of both suction and delivery strokes.

   ii) The power required to drive the pump.

   Take atmospheric pressure as 10.3 m of water.

(b) Explain methods to balance axial and radial thrust in centrifugal pump.   08

Q.7 Write short notes on: (ANY FOUR)   20

   i) Selection of turbines for hydroelectric site.

   ii) Priming in Centrifugal pump.

   iii) Operating characteristic of Centrifugal pump.

   iv) Performance characteristic of Reciprocating pump.

   v) Application of CFD in hydraulic turbines.

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