Roll No. **Total No. of Pages : 02**

Total No. of Questions : 09

B.Tech. (ME) (Sem.–6th)

FLUID MACHINERY

Subject Code : ME-306

Paper ID : [A0821]

Time : 3 Hrs. **Max. Marks : 60**

INSTRUCTION TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students has to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students has to attempt any TWO questions.**

SECTION-A

1. **Answer briefly :**

(a) Why is curved plate preferred over flat plate in hydraulic turbines ?

(b) Write Euler equation for energy transfer in turbo machines.

(c) How would you calculate number of buckets in Pelton turbine ?

(d) What is the difference between Kaplan and propeller turbine ?

(e) What is the function of Surge Tank ?

(f) Define manometric efficiency.

(g) What is the function of airvessel in a reciprocating pump ?

(h) Define specific speed of turbine and write its units.

(i) Why number of blades in Kaplan turbine is less ?

(j) Which turbine is preferred for overload and part load operation ?

SECTION-B

2. A Francis turbine is designed to have runner dia of 3 m operating at 300 rpm under a head of 45 m with overall η of 82% to generate 6.75 MW. Before starting the manufacturing, testing is to be made on model having scale ratio of $\frac{1}{8}$ under head of nine metre. Find speed, discharge and power of model.

3. Losses in a Pelton turbine may be modelled as below :

   Loss due to bucket friction and shock = $K_1 (V - u)^2/2$ g; loss due to bearing friction and windage loss = $K_2 \frac{u^2}{2g}$, where V and u are jet and bucket velocity, K_1 and K_2 are constants.

   Show that the max. η of Pelton turbine occurs

   when $\frac{u}{v} = \frac{1 - \cos\theta + K_1}{2(1 - \cos\theta) + K_1 + K_2}$. Where θ is bucket angle at outlet.

4. A Kaplan turbine develops 246476 kW power at 39 m head. Assuming speed ratio of 2, flow ratio 0.6, dia of loss equal to 0.35 times diameter of runner and η of 90%, find dia and speed of turbine.

5. From the first principles show that the work saved against friction in delivery pipe of a single acting reciprocating pump, by fitting an air vessel is 84.8%. What is the purpose of fitting an air vessel in a reciprocating pump ?

6. The diameter of a centrifugal pump at inlet and outlet are 30 cm and 60 cm respectively. Find the minimum starting speed of pump if it works against a head of 30 m.

SECTION-C

7. A single acting reciprocating pump has a bore of 15 cm and a stroke of 30 cm. The suction pipe has a dia of 10 cm and is fitted with air vessel. Find rate of flow into or from airvessel at $\theta = 30°$ and 90°. Also find crank angle at which there is no flow into or from air vessel. The pump runs at 120 rpm and the piston has S.H.M.

8. (a) Define specific speed of a centrifugal pump and derive an expression for the same.

   (b) Show that Pelton Turbine is a low specific speed turbine.

9. Write short notes on (**any two**) :

   (a) Carcitation in Hydraulic machines.

   (b) Differential Accumulator

   (c) Design of Francis turbine.