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Total No. of Questions : 09

B.Tech.(AE) (2018 Batch) (Sem.–3)

FLUID MECHANICS AND FLUID MACHINES

Subject Code : BTAE303-18

M.Code : 76401

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS 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 have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. Answer briefly :

a) Explain the variation of friction factor for laminar and turbulent flows.

b) Show the velocity distribution for ideal and real fluids.

c) Sketch the boundary layer separation in a diverging channel by showing at least three velocity profiles.

d) What is the variation of viscosity with temperature for fluids?

e) What is the difference between gauge pressure and absolute pressure?

f) What is meant by dynamic similarity'? What are the non-dimensional numbers associated with dynamic similarity?

g) What is specific speed of a pump? How are pumps classified based on this number?

h) Give an example for a low head turbine, a medium head turbine and a high head turbine.

i) What is a Draft tube? In which type of turbine, it is mostly used?

j) Define and explain Reynolds number, Froude's number, Euler's number and Mach number.

SECTION-B

2. A 3.6m wide rectangular channel carries water to a depth of 1.8m. In order to measure the discharge, the channel width is reduced to 2.4m and a hump of 0.3m height is provided in the bottom. Calculate the discharge if water surface in the contracted section drops by 0.15m. Assume no losses.

3. Two reservoirs are connected by a pipe which is 150 mm in diameter for the .first 10 m and 250 mm in diameter for the remaining 15 m. The water surface in the upper reservoir is 7.5 m above that in the lower reservoir. Calculate the flow rate through pipe and draw HGL and TEL. Take friction factor as 0.04 for both the pipes

4. Derive Euler's equation of motion for flow along a stream line. What are the assumptions involved?

5. A power transmission pipe 10 cm diameter and 500 m long is fitted with a nozzle at the exit, the inlet is from a river with water level 60 m above the discharge nozzle.

   Assume f = 0.02, calculate the maximum power which can be transmitted and the diameter of nozzle required.

6. Define Cavitation and discuss its causes, effects and prevention.

SECTION-C

7. A Francis turbine with an overall efficiency of 76% and hydraulic efficiency of 80% is required to produce 150 kW. It is working under a head of 8 m. The peripheral velocity is $0.25\ \sqrt{2gH}$ and radial velocity of flow at inlet is $0.95\ \sqrt{2gH}$. The wheel runs at 150 rpm : Assuming radial discharge, determine :

   a) Flow velocity at outlet

   b) The wheel angle at inlet

   c) Diameter and width of the wheel at inlet.

8. Using Buckingham's π-theorem, show that the velocity through a circular orifice in a pipe is given by $v = \sqrt{(2gH)}\ f\ \{d/H, \mu/\rho vH\}$ where v is the velocity through orifice of diameter d and H is the head causing the flow and ρ and μ are the density and dynamic viscosity of the fluid passing through the orifice and g is acceleration due to gravity.

9. The velocity distribution in the boundary layer is given by $u/U = y/\delta$. where u is the velocity at a distance y from the plate u = U at y = δ, δ being boundary layer thickness. Find the displacement thickness, momentum thickness and energy thickness.

NOTE : Disclosure of Identity by writing Mobile No. or Making of passing request on any page of Answer Sheet will lead to UMC against the Student.