MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CE(ES)401 Introduction to Fluid Mechanics

UPID : 004443

Time Allotted : 3 Hours   *Full Marks :70*

The Figures in the margin indicate full marks.

Candidate are required to give their answers in their own words as far as practicable

Group-A (Very Short Answer Type Question)

1. Answer any ten of the following :   [1 x 10 = 10]

  (I) Which is the mathematical technique used to predict physical parameters?

  (II) What is the maximum number of times the pathlines of two particles can intersect in an one dimensional flow?

  (III) The rise in the level of a liquid in a tube is h. If half the amount is poured outside, what will be the new rise in liquid level?

  (IV) For an incompressible fluid does density vary with temperature and pressure?

  (V) What is fluid mechanics used for?

  (VI) Which is the standard symbol for Archimedes number?

  (VII) What is model testing?

  (VIII) Where does open channel flow takes place?

  (IX) Which equation must be perfunctorily satisfied while dealing with fluid flow problems?

  (X) What type of flow can be taken for granted in a pipe of a uniform cross-section?

  (XI) When is the fluid flow called laminar?

  (XII) Pressure intensity or force due to pressure gradient for fluid at rest is considered as which kind of force?

Group-B (Short Answer Type Question)

Answer any three of the following :   [5 x 3 = 15]

2. The shear stress at a point in a liquid is found to be 0.03 N/m^2. The velocity gradient at the point is 0.15 s^{-1}. What will be it's viscosity (in Poise)?   [5]

3. 12litres of a liquid of sp.gr.1.3 is mixed with nine litres of a liquid of sp. gr. 0.8. If the bulk of the liquid shrinks 1% on mixing, calculate the sp.gr, the volume and the weight of the mixture.   [5]

4. If 200 m^3 of fluid has a weight of 1060 N measured on the planet having acceleration due to gravity 6.625m/s^2, what will be it's specific volume?   [5]

5. Obtain an expression for capillary rise of a liquid.   [5]

6. Write a detailed note on differential manometer and piezometer.   [5]

Group-C (Long Answer Type Question)

Answer any three of the following :   [15 x 3 = 45]

7. (a) Write about the different physical properties of fluids.   [5]

  (b) Write a detailed note on pressure and specific weight relationship.   [5]

  (c) Write a detailed note on differential manometer and Borden Gauge.   [5]

8. (a) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 120 cm and flow area is 0.4 m^2. The angles made by the obsolete and relative velocities at the inlet is 20° and 60° respectively with the tangential velocity. Determine the power developed. Assume the whirl velocity at outlet is zero.   [5]

  (b) A double jet impulse turbine has to develop 3000 kW at 400 rpm under a head of 270 m. if the overall efficiency is 0.90, determine the (1) diameter of the nozzle.Take coefficient of velocity as 0.95 and diameter of runner as 1.5 m.   [5]

  (c) A double jet impulse turbine has to develop 3000 kW at 400 rpm under a head of 270 m. if the overall efficiency is 0.90, determine the specific speed. Take coefficient of velocity as 0.95 and diameter of runner as 1.5 m.   [5]

9. (a) If u=x and v=-y describes a certain flow field, determine whether or not the equation of continuity is satisfied. Also investigate the types of flow models.   [7]

(b) Derive the equation of continuity for incompressible fluid. [6]

(c) Define the vertex line. [2]

10. (a) Draw the velocity triangle for Pelton turbine when horizontal component of is less than u^2. [5]

(b) What is the significance of draft tube in reaction turbine? [5]

(c) Write the Euler's equation of hydrodynamics machines. [5]

11. (a) A three stage centrifugal pump has impeller of 40 cm in diameter and 2.5 cm wide at outlet. The vanes are curved back at the outlet at 30° and reduce the circumferential are by 15%. The manometric efficiency is 85% and overall efficiency is 75%. Determine the head generated by the pump when running at 12000 rpm and discharging 0.06 m^3/s. Also find shaft horse power. [7]

(b) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 120 cm and flow area is 0.4 m^2. The angles made by the obsolete and relative velocities at the inlet is 20° and 60° respectively with the tangential velocity. Determine the volume flow rate Assume the whirl velocity at outlet is zero. [4]

(c) A reaction turbine works at 450 rpm under a head of 120 m. Its diameter at inlet is 120 cm and flow area is 0.4 m^2. The angles made by the obsolete and relative velocities at the inlet is 20° and 60° respectively with the tangential velocity. DetermineHydraulic Efficiency. Assume the whirl velocity at outlet is zero. [4]

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