



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} .
1. What will be it's viscosity (in Poise)?
3. 12 litres 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 6.625 m/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 absolute 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 u 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 area 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 $0.06 \text{ m}^3/\text{s}$. 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 absolute and relative velocities at the inlet are 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 absolute and relative velocities at the inlet are 20° and 60° respectively with the tangential velocity. Determine Hydraulic Efficiency. Assume the whirl velocity at outlet is zero. [4]

*** END OF PAPER ***

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