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Total No. of Questions : 09

B.Tech. (CE) (Sem.–3)(2011 Batch)

FLUID MECHANICS-I

Subject Code : BTCE-301

Paper ID : [A1113]

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. Write briefly :

   a. Draw a stress-strain diagram for different types of fluids.

   b. Explain hydrostatic paradox.

   c. Define horizontal and vertical component of hydrostatic force acting on a curved surface.

   d. What are the methods of describing fluid motion?

   e. Derive an expression for circulation around a rectangular flow field.

   f. How would you determine the torque exerted on a flow along a curved streamline?

   g. What is kinetic energy correction factor and what is its significance?

   h. Explain the term hydraulic similitude.

   i. What is Magnus effect? Give some practical examples where this effect is noticeable.

   j. Differentiate between notches and weirs.

SECTION B

2. A circular disc of diameter 300 mm and weight 50 N is kept on an inclined surface with a slope of 30°. The space of 2 mm between the disc and inclined surface is filled with oil of viscosity 10 P. What force will be required to pull the disc up the inclined plane with a velocity of 0.5 m/s ?

3. The level of mercury in a U-tube manometer of diameter 10 mm is 150mm. If 15cm^3 of water is poured into one of the two limbs of manometer, find the difference in levels of mercury in the two limbs of manometer.

4. The stream function in two-dimensional flow is $\Psi = (6x - 4y + 7xy)$. Verify whether the flow is rotational or irrotational and determine expression for the potential function. Also, determine the direction of a streamline passing through point (1,-1).

5. The rate at which water flows through a horizontal pipe of diameter 250 mm is increased linearly from 30 to 150 litres per sec in 3.5 seconds. What pressure gradient must exist to produce this acceleration? What difference in pressure intensity will prevail between two sections 8 m apart?

6. Calculate the total drag, shear drag and the pressure drag exerted per meter length of cylinder of diameter 30 mm due to air flowing at 3.6 m/minute. The density of air is 1.236 kg/m^3. Take total drag coefficient =1.4 and shear drag coefficient = 0.185.

SECTION C

7. A cylindrical buoy 2 m diameter, 2.5 m long and weighing 21.5 kN, is floating in sea water (specific weight = 10.02 kN/m^3). Show that the buoy cannot float with its axis vertical. What minimum pull should be applied to a chain attached to the center of the base to keep the buoy vertical?

8. The time period T of water surface waves is known to depend on the wave length λ, depth of flow D, density of fluid ρ, acceleration due to gravity g and surface tension σ. Obtain the dimensionless form of the functional relationship using π-theorem method.

9. A venturimeter with throat-pipe diameter ratio as 1/2 is fitted in a pipe of diameter 200 mm carrying water. The head loss between inlet and throat is 10% of velocity head at throat. Calculate discharge when an inverted U-tube water-oil differential manometer shows a reading of 300 mm. Assume specific gravity of oil as 0.75. Also, find coefficient of discharge of venturimeter.