

Roll No. 

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech.(CE) (2011 Onwards) (Sem.-3)

**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 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) Write briefly :**

- a) Define surface tension.
- b) Calculate the height of water column corresponding to a pressure equivalent of 75 cm of mercury column.
- c) Calculate the depth of centre of pressure in a rectangular lamina immersed vertically in water upto height  $h$ .
- d) Define streamline.
- e) Define kinetic energy correction factor.
- f) Define repeating variables.
- g) State true or false for the following sentence. If false, write the correct statement. "*In river models, Froude model law is the basic similitude criterion*".
- h) Draw the graph between coefficient of drag and reynolds number for a sphere.
- i) What is the function of a pitot tube?
- j) State the momentum equation.

**SECTION-B**

- 2) Check whether the flow defined by the stream function  $\psi = 2xy$  is irrotational? If so, determine the corresponding velocity potential.
- 3) How is the drag and lift forces caused on a body immersed in a moving fluid?
- 4) State the principle of pressure measurement by manometer. Explain the difference between a simple and a differential manometer.
- 5) A 30 cm diameter pipe carries water under a head of 20 metres with a velocity of 3.5 m/sec. If the axis of the pipe turns through  $45^\circ$ , find the magnitude and direction of the resultant force on the bend.
- 6) In 1 in 20 model of stilling basin, the height of hydraulic jump in the model is observed to be 20 cm. What would be the corresponding height of jump in the prototype? If energy dissipation in the model is 0.1 kW, what would be the corresponding value in the prototype?

**SECTION-C**

- 7) A thin plate of area  $A$  is placed midway in a gap of height  $h$  between two horizontal plane surfaces. The gap is filled with oil of viscosity  $\mu_1$  and the plate is pulled edgewise with a constant velocity  $v$ . The gap is next filled with a lighter oil of viscosity  $\mu_2$  and the plate is located unsymmetrically in the gap but parallel to the walls. Experiments indicate that for the same velocity  $v$  the force required was same. Establish a relation for  $\mu_2$  in terms of  $\mu_1$  and the distance from the near wall to the plate.
- 8) A square door with side dimensions 30 cm is provided in the side wall of a tank which is filled with water of specific weight  $9790 \text{ N/m}^3$ . What force must be applied at the lower end of the gate so as to hold the hinged door closed? The hinged end of the door lies at a depth of 3 m from the free water surface. How this force would change if the water is subjected to a pressure of  $0.5 \times 10^5 \text{ N/m}^2$ .
- 9) Derive the Euler's equation of motion along a streamline, and hence derive the Bernoulli's theorem.