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**3E1625****3E1625****B.Tech. III Semester (Main/Back) Examination Dec. - 2016****Civil Engg.****3CE5A Fluid Mechanics****Time : 3 Hours****Maximum Marks : 80****Min. Passing Marks : 26****Instructions to Candidates:**

*Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/calculated must be stated clearly.*

**Unit - I**

1. a) Discuss Newtonian and Non - Newtonian fluids with characteristic plots. (6)
- b) Determine the mass and the weight of the air contained in a room whose dimensions are  $6\text{m} \times 6\text{m} \times 8\text{m}$ . Assume the density of air is  $1.16 \text{ kg/m}^3$ . (10)

**OR**

1. a) Derive the equation of capillary rise, stating meaning of terms used with neat sketches. (6)
- b) Density of sea water at the surface was measured as  $1040 \text{ kg/m}^3$  at an atmospheric pressure of 1 bar. At certain depth in water, the density was found to be  $1055 \text{ kg/m}^3$ . Determine the pressure at that point. The bulk modulus is  $2290 \times 10^6 \text{ N/m}^2$ . (10)

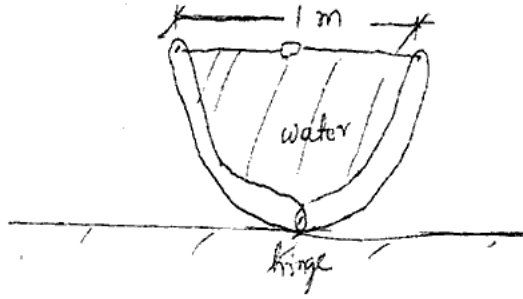
**Unit - II**

2. a) With neat sketch explain gauge pressure and absolute pressure. (6)
- b) Consider a large cubic ice block floating in sea water. The specific gravity of ice and sea water are 0.92 and 1.025 respectively. If a 10 cm high portion of the ice block extends above the surface of water, determine the height of ice block below the surface. (10)

**OR**

2. a) With clean diagram state and explain Archmedes principle. (6)
- b) A water trough of semicircular cross section of radius 0.5 m consists of two symmetric parts hinged to each other at the bottom, as shown below. Two

parts are held together by a cable and turnbuckle placed every 3 m along the length of the trough. Calculate tension in each cable when the trough is filled to the rim. (10)



### Unit - III

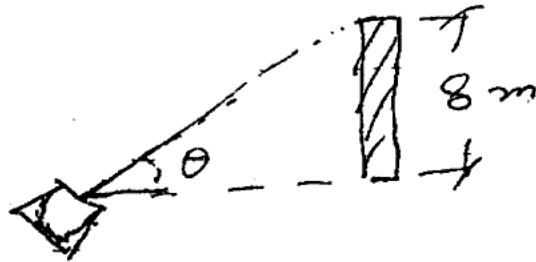
3. a) Define, stream line, streak line, path line and give their differences. (6)
- b) A 1.2 m dia, 3m high sealed vertical cylinder is completely filled with gasoline whose density is  $740 \text{ kg/m}^3$ . The tank is now rotated about its vertical axis at a rate of 70 rpm. Determine the difference between the pressures at the centres of the bottom and top surfaces. (10)

OR

3. a) Classify the fluid flow. (6)
- b) The velocity field in the fluid is given by  $\vec{v} = (3x + 2y)\hat{i} + (2z + 3x^2)\hat{j} + (2t - 37)\hat{k}$
- i) What are velocity components  $u, v, w$ .
- ii) Determine speed at the point (1, 1, 1).
- iii) Determine speed at time  $t = 2\text{s}$  at point (0, 0, 2). (10)

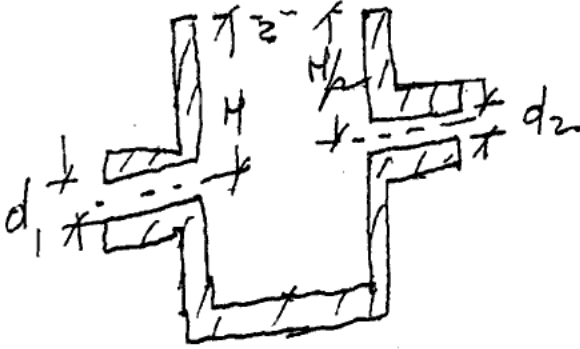
### Unit - IV

4. a) Derive Euler's equation of motion for flow along a stream line. (8)
- b) A vertical wall is of 8 m in height. A jet of water is coming out from a nozzle with a velocity 20 m/s. The nozzle is situated at a distance of 20 m from the vertical wall. Find the angle of projection of nozzle to the horizontal so that the jet just clears the top of wall. (8)



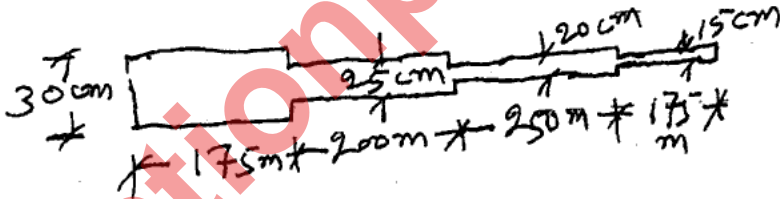
OR

4. a) Describe the working principle of venturimeter. (6)  
b) A tank as shown in figure below has a nozzle of exit diameter  $d_1$  at a depth  $H$  below free surface. At the side opposite to that of nozzle 1, another nozzle is proposed at depth  $H/2$ . What should be diameter  $d_2$  in terms of  $d_1$  so that the net horizontal force on tank is zero. (10)



Unit - V

- a) Derive Darcy's formula for friction loss. (8)  
b) An existing pipe line 800 m long is shown in figure below. Neglecting minor losses, find the diameter of uniform pipe of 800 m length to replace the compound pipe. rtuonline.com (8)



OR

5. a) Briefly discuss various types of minor losses in pipe flow. (8)  
b) A 25 cm diameter 2 km long horizontal pipe is connected to a water tank. The pipe discharges freely into atmosphere on the down stream side. The head over the centre line of pipe is 32.5 m;  $f = 0.0185$ . Find discharge through pipe. (8)

