Con. 6509-13. **LJ-10409**

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question no. **1** is **compulsory**.
(2) Answer any **four** questions from the remaining **six** questions.
(3) Assum suitable data if necessary and state from clearly.
(4) **Figures** to the **right** indicate **full** marks.

1. Explain any **four** :- **20**
   (a) Explain capillarity and bulk modulus.
   (b) Define atmospheric, gauge, absolute and vaccum pressures.
   (c) Explain principle of floation.
   (d) Explain classification of fluid flow.
   (e) Write Bernoullis equation and its limitation.
   (f) Explain circulation and voriticity.
   (g) A rectangular orifice of size 1.8 m wide and 1.2 m deep is discharging water from a tank. The water level in the tank is 3.5 m higher from the centre of the orifice. Find the discharge through the orifice. Take Cd=0.62.

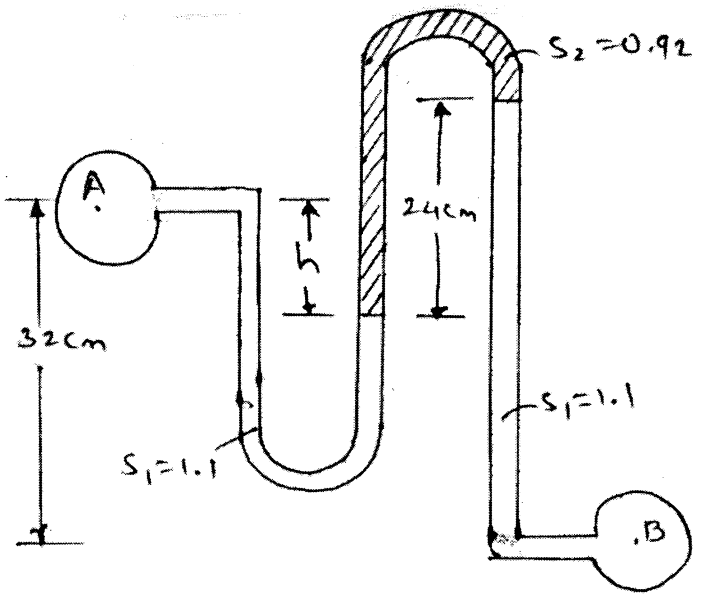
2. (a) Derive an expression for vertical single column manometer. **6**

   (b) A block of base 24 cm^2, weight 120 N slides down plane over an oil film of thickness 0.1 cm coefficient of viscosity 50 $N.s/m^2$. Estimate the steady state velocity of the block if the inclination of plane is 25°. **6**

   (c) Calculate the gauge pressure and the absolute pressure within- **8**
      (i) a jet of water 0.5 cm dia.
      (ii) a droplet of water 0.5 cm dia.
      (iii) a bubble of water 0.5 cm dia.
   Assume surface tension of water as 0.075 N/m and atmospheric pressure as 101300 N/m^2.

3. (a) Derive an expression of total pressure and centre of pressure for vertical plane lamina submerged in liquid **6**

3. (b) Find pressure difference between two points A and B when inverted U-tube manometer is connected to pipes A and B as shown in figure. **6**



(c) A solid cylinder 10 cm dia and 40 cm long is made of two materials. The bottom 1 cm is of material of sp. gr. 6.5 and the portion above of sp gr. 0.6. Does the cylinder float vertically in water of sp. weight 1000 kg/m^3. **8**

4. (a) Explain practical applications of Bernaulli's equation in detail. **6**

(b) A venturimeter measures the flow of water in a 75 mm dia. pipe. The difference of head between the throat and entrance of the meter is measured by a U-tube containing mercury, the mercury being in contact with the water. What should be the dia. of throat of the meter in order that the difference in level of the mercury be 25 cm. When the quantity of water flowing in the pipe is 650 lpm. Cd=0.97. **8**

(c) A tank has two identical orifices in one of its vertical sides. The upper orifice is 3.2 m below the water surface and lower one is 5.5 m below the water surface. Cv value for each orifice is 0.96. Find the point of intersection of two jets. **6**

5. (a) Write down advantages of triangular notch over rectangular notch. **10**

(b) Find the inclination angle of fire hose nozzle, held at a height of 2 m above the ground to direct the jet, having a velocity 35 m/sec. to reach a point which is at a height of 25 m and 30 m away horizontally. **10**

6. (a) The velocity potential for flow is given by $\phi = 4 (x^2 - y^2)$. Determine the stream function ϕ for field. **3**

   (b) A pipe converges uniformly from 0.6 m diameter to 0.3 m diameter over 3 m length. Water flow through the pipe at a rate of 35 lit/sec. Find the convective accleration at the middle of the pipe. **5**

   (c) An external convergent - divergent mouthpiece has 5 cm dia. at the section where the convergent and divergent portions meet. Water is discharged through the mouthpiece under a head of 3 m above its centre line. Determine the max. discharge and the corresponding diameter at outlet. The maximum vaccum head allowed is 8 m of water. **7**

   (d) Short note on velocity measuring devices. **5**

7. Short notes (any **four**) :- **20**

   (i) Effect of temperature on viscosity.

   (ii) Mechanical gauges.

   (iii) Determination of metacentric height

   (vi) Flow net

   (v) Classification of notches and weirs.

   (vi) Control volume and control surface.
