

S.E. Sem. III [CIVIL]
Fluid Mechanics - I
Prelim Question Paper

Time : 3 Hrs.]

[Marks : 80

- N.B.:** (1) Question No. 1 is **compulsory**.
(2) Attempt any **THREE** out of remaining FIVE questions.
(3) Assume suitable data if necessary.
(4) Illustrate with **neat** diagrams wherever necessary.
1. (a) Define Total pressure and center of pressure. [2]
(b) Write the classification of Orifice. [2]
(c) Define vorticity and circulation. [2]
(d) Write classification of fluids based on viscosity. [2]
(e) State Bernoulli's theorem. [2]
(f) Define source, sink. [2]
(g) State Pascals law. [2]
(h) Differentiate between pathline, streamline, streakline. [2]
(i) Define notch and weir. [2]
(j) Define nappe and sill. [2]
2. (a) Water in a container experiences a pressure increase a 820 KPa above atmospheric pressure. Find reduction in volume taking $K_{\text{water}} = 2.2 \times 10^9$ Pa. [5]
(b) A stone weighs 400 KN in air and 225 KN when immersed in water. Calculate the volume of the stone and its relative density. [5]
(c) A tank with vertical sides of 1 m is square in plan with side 1 m long. It contains oil of specific gravity 0.82 to a depth of 25 m floating on 75 m depth of water. Calculate the total pressure on one side of the tank. [10]
3. (a) Differentiate between simple and differential manometer. [4]
(b) A container having dimension 7m \times 2m and 2.5 m deep contains water 1.25 m deep. The container moves with an acceleration 3 m/s² up to 20° inclined plane. Find the inclination of water surface with horizontal. [6]
(c) A gate 3 m wide, 2 m high separates a liquid of specific gravity 1.5 and height 2 m on one side and water upto 1.5 m on other side of gate. Find the forces acting on the two sides of the gate and the resultant force acting on the gate and its location. [10]

4. (a) What do you understand by Lagrangian and Eulerian method. [4]
(b) The velocity components in 2 dimensional incompressible flow is given by :
$$U = y^3 + 6x - 3x^2y$$
$$V = 3xy^2 - 6y - x^3$$

(i) Is the flow continuous? [4]
(ii) Find whether the flow is rotational or irrotational. [4]
(iii) Determine the potential function. [4]
(iv) Determine the stream function. [4]
5. (a) Sketch a pitot tube and explain its working. [6]
(b) Write on Cipolletti weir. [4]
(c) An oil of specific gravity of 0.90 is flowing through a venturimeter having inlet and throat diameter as 30 cm and 15 cm respectively. The oil mercury differential manometer shows a reading of 250 mm. The throat is 30 cm above inlet section. Find the discharge of oil through the venturimeter when it lies in horizontal plane. [10]
6. (a) Water flow over a rectangular sharp crested weir of 1 m height, extends across a rectangular channel of 3 m width. If head of water over the weir is 0.4 m, determine the discharge. Consider the velocity of approach. Take $C_d = 0.62$. [10]
(b) An external cylindrical mouthpiece of diameter 100 mm is discharging water under a constant head of 8 m. Determine the discharge and absolute pressure head of water at vena contracta. Take $C_d = 0.855$, C_c for vena contracta = 0.62 atmospheric pressure head = 10.3 m of water. [10]

