

(3 Hours)

[Total Marks : 80

- N.B. :** (1) Question No.1 is compulsory.
(2) Attempt any **three** questions out of remaining **five** questions.
(3) Assume any additional **data** if **necessary** and state **clearly**.

1. Attempt any **five** :-

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- Define vapour pressure and viscosity.
- Define the term total pressure and centre of pressure.
- Describe Archimedes principle.
- Define the term circulation and vorticity.
- Write the classification of orifices.
- Define the term source, sink and doublet.
- Write on cipolletti weir.

2. (a) (i) Find the increase in pressure requires to produce 1 percent reduction in volume of water. Take bulk modulus of elasticity of water $k = 2.16$ GPa. 5

(ii) A driver is working at a depth of 20m below the surface of sea water (sp.wt = 10KN/m^3). Calculate the pressure intensity at this depth. What would be the absolute pressure if barometer reads 760mm of mercury column at the sea level. 5

(b) (i) A tank is filled with water under pressure and the pressure gauge fitted at the top indicates a pressure of 15KPa. The tank measures 2.5m perpendicular to the plane of the paper, and the curved surface AB of the top is the quarter of a circular cylinder of radius 2m. Determine (a) Horizontal and vertical components of fluid pressure on the curved surface AB and (b) Magnitude and direction of resultant force. 10

3. (a) (i) A stone weighs 400KN in air and when immersed in water it weighs 225N. Calculate the volume of the stone and it's relative density. 5

(ii) What distance must the sides of a tank be carried above the surface of water contained in it, if the tank is to undergo uniform horizontal acceleration of 3m/s^2 without spilling any water. 5

(b) Water flows through a pipe AB 1.2 m diameter at 3m/s and then passes through a pipe BC 1.5m diameter. At C, the pipe branches. Branch CD is 0.8m, in diameter and carries one-third of the flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE 10

4. (a) Determine the velocity and acceleration at point P(x = 1m, y = 3m) 20
 (b) Is the flow physically possible? If so obtain an expression for the stream function.
 (c) What is the discharge between the streamlines passing through (1,3) and (2,3)?
 (d) Is the flow irrotational? If so determine the corresponding velocity potential.
 (e) Show that each of the stream and potential functions satisfy Laplace equation.

The velocity components in a two dimensional incompressible flow field are expressed as :

$$u = \frac{y^3}{3} + 2x - x^2y$$

$$V = xy^2 - 2y - \frac{x^3}{3}$$

5. (a) A venturimeter 24 cm x 12 cm installed in a vertical pipe line carrying an oil of relative density 0.90. The throat is 30cm above the inlet section. A differential U tube manometer connected to inlet and throat section shows a gauge deflection of 12 cm. Find discharge if $C_d = 0.98$. 8
 (b) A right circular cylinder of radius R and height H is open at top and completely filled with a liquid. At what speed must it rotate in order that the effect of rotation will be to discharge just sufficient quantity of water to expose half of circular area at the bottom. 12
6. Write a short note on :- 20
- Weir and their classification
 - Notch and their classification
 - Various coefficients of orifice
 - Mouthpiece and its advantages
 - Different energies of a fluid.