EXAMPLE SHEET 4

1. Define the following terms: (i) Total pressure and (ii) Centre of Pressure
2. Derive an expression for total pressure and centre of pressure for a vertically immersed surface.
3. Derive an expression for the depth of centre of pressure from free surface submerged in the liquid.
4. A rectangular plate 2 m × 4 m is vertically immersed in water in such a way that the 2 metres side is parallel to the water surface and 2.5 metres below it. Find the total pressure on the rectangular plate. Take w = 9.81 kN/m^2.
5. A circular door of 0.5 m diameter closes on an opening in the vertical side of a bulk head, which retains water. The centre of the opening is at a depth of 2 m from the water level. Determine the total pressure on the door. Take specific gravity of sea water as 1.03.
6. A circular plate of diameter 1.5 m is placed vertically in water in such a way that the centre of the plate 3 m below the free water surface. Determine (i) total pressure on the plate and (ii) position of the centre of pressure.
7. An isosceles triangular plate of base 5 m and altitude 5 m is immersed vertically in an oil of specific gravity 0.8. The base of the plate is 1 m below the free water surface, determine the total pressure and the position of centre of pressure.
8. A tank contains water up to a height of 0.5 m above the base. An immiscible liquid specific gravity 0.8 is filled on the top of water up to 1 m height. Calculate the total pressure and the position of centre of pressure on one side of the tank, which is 2 m wide.
9. A rectangular plane surface 1 m wide and 3 m deep lies in water in such a way that its plane makes an angle of 30^o with the free water surface. Determine the total pressure and position of centre of pressure when the upper edge is 2 m below the free surface.
10. A masonry dam 7 m high has a top width of 1.5 m and bottom of 5 m. Maximum water level in the dam is 1.0 m below the top of the dam. Determine the maximum and minimum pressure intensities at the base when the dam is full. Take weight of water = 9.81 kN/m^3 and weight of masonry = 21.6 KN/m^3.
11. What is buoyancy? What is centre of buoyancy?
12. Explain briefly the following types of equilibrium of floating bodies: (i) stable equilibrium, (ii) Unstable equilibrium, and (iii) Neutral equilibrium
13. Define and explain the following terms (i) Metacentre, (ii) Metacentric Height.
14. Using the analytical method derive an expression for Metacentric height (GM).
15. A wooden block of width 2.5 m, depth 1.5 m and length 6 m is floating horizontally in water. If the specific gravity of the block is 0.65, find the volume of water displaced and the position of centre of buoyancy.
16. The following data relate to pontoon floating in sea water: length = 5 m, width = 3 m, height = 1.2 m, depth of immersion = 0.8 m, centre of gravity above the bottom
17. A solid cylinder 4 m in diameter and 4 m high is floating in water with its axis vertical. If its specific gravity is 0.6, find the metacentric height. Also state whether the equilibrium is stable or unstable.
18. A hollow wooden cylinder of specific gravity 0.56 has an outer diameter of 600 mm and an inner diameter of 300 mm. It is required to float in oil of specific gravity 0.85. Calculate (i) the maximum length/height of the cylinder so that I shall be stable when floating with is axis vertical, (ii) the depth to which it will sink.