

Section IV

8. Explain the work done in compressing a gas when the change is :
(i) adiabatic
(ii) isothermal. 5
9. A straight tube, closed at one end and open at other, revolves with a constant angular velocity about an axis, meeting the tube at right angle; neglecting the action of gravity. Find the density of the air within the tube at any point. 5



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B.A. (Hons.) EXAMINATION, 2025

(Sixth Semester)

(Regular & Re-appear)

MATHEMATICS

BM-365 Opt. (i)

Hydrostatics

Time : 3 Hours]

[Maximum Marks : 26

Before answering the question-paper, candidates must ensure that they have been supplied with correct and complete question-paper. No complaint, in this regard will be entertained after the examination.

Note : Attempt *Five* questions in all, selecting *one* question from each Section. Q. No. **1** is compulsory.

1. Define the following :

- (a) Metacentre 2
- (b) Density of fluid 2
- (c) Heterogeneous fluid. 2

Section I

2. (a) Find the whole pressure on a triangle the depth of whose vertices are α , β , γ , the liquid being homogeneous and S is the area of the triangle. 3
- (b) Prove that the depth of C.P. always exceeds that of C.G. of plane area. 2
3. (a) The pressure at bottom of well is 4 times that depth of 2 feet. Find the depth of the well if the atmospheric pressure be equivalent to that of 30 feet water. 3
- (b) Find the pressure at depth z below the surface of heavy homogeneous liquid at rest under gravity, exposed to the pressure of atmosphere. 2

Section II

4. A quadrant of an ellipse is immersed vertically in a homogeneous liquid with major axis in the free surface. Find the centre of pressure. 5
5. A cylindrical vessel of radius r and height h full of water density ρ is held with its axis inclined at angle 45° to the vertical. Find the resultant pressure on the curved surface. 5

Section III

6. A body floating in water has volumes V_1 , V_2 , V_3 above the surface when the densities of the surroundings air are ρ_1, ρ_2, ρ_3 . Prove that :

$$\frac{\rho_2 - \rho_3}{V_1} + \frac{\rho_3 - \rho_1}{V_2} + \frac{\rho_1 - \rho_2}{V_3} = 0. \quad 5$$

7. If the floating solid be a cylinder, with its axis vertical and ratio of whose specific gravity to that of liquid is σ , prove that equilibrium will be stable if the ratio of the base to the height be greater than $[\frac{2\sigma}{1 - \sigma}]^{1/2}$. 5