

Time : 3 Hours

Max. Marks : 60

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/continuation sheet will be issued.

Note: Attempt Five questions in all, selecting one question from each section A, B, C and D. Q.No.9 is compulsory.

SECTION-A

- (a) How does viscosity of a fluid vary with temperature? (5)
(b) Define surface tension. Establish relationship among surface tension (σ), pressure droplet of liquid in excess of outside pressure (p), dia. of droplet d . (5)
- Explain the procedure of finding hydrostatic forces on curved surfaces. (10)

SECTION B

- A source and a sink of strength $4 \text{ m}^2/\text{s}$ and $8 \text{ m}^2/\text{s}$ are located at $(-1, 0)$ and $(1, 0)$ respectively. Determine the velocity and stream function at a point $P (1, 1)$ which is lying on the flownet of the resultant stream line. (10)
- State Bernoulli's theorem for steady flow of an incompressible fluid. Derive an expression for Bernoulli's theorem from first principle and state the assumptions made for such a derivation. (10)

SECTION C

- Prove that the discharge through a triangular notch or weir is given by

$$Q = \frac{8}{15} C_d \times \tan \frac{\theta}{2} \times \sqrt{2g} \times H^{3/2}$$

Where H = head of water over the notch or weir

θ = angle of notch or weir. (10)

- The pressure difference ΔP in a pipe of diameter D and length l due to turbulent flow depends on the velocity V , viscosity μ , density ρ and roughness k . Using Buckingham's π -theorem, obtain an expansion for ΔP . (10)

SECTION D

- (a) What is a syphon? Where is it used? Explain its action. (5)
(b) Explain the phenomenon of Water Hammer. (5)
- Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe diameter 300 mm and length 400 m. The rate of flow of water through the pipe is 300 litres/s. Consider all losses and take the value of $f = .008$. (10)

SECTION E

(Compulsory Questions)

- Answer the following questions:
 - State the Newton's law of viscosity.
 - Difference between specific weight and specific volume of fluid.
 - What is a fluid?
 - State the Pascal's law.
 - What do you understand by 'Total pressure' and 'Center of pressure'?
 - Define the terms 'Meta-centric height'.
 - Define the terms 'steady flow and unsteady flows'.
 - What is Venturimeter?
 - Define Vena-contracta.
 - What do you mean by 'viscous flow'? (2×10=20)