



### SECTION-B

2. How will you apply momentum equation for determining the force exerted by a flowing fluid on a pipe bend?
3. What is venturi-meter? Where do we use it? Write the principle and construction of venturi-meter and derive an expression for flow through venturi-meter.
4. Establish the Bernoulli's theorem from the Euler's equation of motion through stream line tube. Mention the assumptions made.
5. What are the various methods of dimensional analysis to obtain a functional relationship between various parameters affecting a physical phenomenon? Describe with an illustration.
6. Prove that for a steady laminar flow between two fixed parallel plates, the velocity distribution across the section is parabolic and that the average velocity is  $2/3^{\text{rd}}$  of the maximum velocity.

### SECTION-C

7. Sketch the stream lines represented by :
  - a)  $\Psi = x^2 + y^2$
  - b)  $\Psi = x^2 - y^2$
8. An aircraft propeller of diameter  $d$  rotating at a speed  $N$  and advancing with speed  $v$  in air of density  $\rho$  and viscosity  $\mu$  develops a thrust  $V$ . Using Buckingham Pi-theorem, show that the thrust developed can be related through :

$$\pi_1 = \phi(\pi_2, \pi_3)$$

$$\text{Where, } \pi_1 = T/\rho V^2 d^2, \quad \pi_2 = \rho V d / \mu \quad \text{and} \quad \pi_3 = d N / V$$

If the effect of Reynolds number is relatively small, establish the value of corresponding speed for testing propellers.

9. A 30 cm diameter pipe carries water under a head of 20 meters with a velocity of 3.5m/s. if the axis of the pipe turns through  $45^\circ$ ; find the magnitude and direction of the resultant force on the bend.