

(3 Hours)

[Total Marks: 80]

- N.B.: (1) **Question No.1 is Compulsory.**  
 (2) Attempt any three Questions out of remaining five questions.  
 (3) Figures to the right indicate full marks.  
 (4) Assume any suitable data if necessary and justify the same.

- Q1** Solve any **FOUR**
- A) Explain methods to control boundary layer separation **5**
- B) Derive an expression for theoretical Discharge through venturimeter with neat sketch. **5**
- C) Explain in detail the classification of fluid flow **5**
- D) Explain the Archimedes principle and condition of Stability of Submerged body **5**
- E) Define the following properties of fluid : **5**  
 (i) Specific weight (ii) Specific Gravity (iii) Viscosity (iv) Surface tension  
 (v) Capillarity
- Q2** A) Derive the expression for the total pressure force and centre of pressure an inclined surface submerge in liquid. **10**
- B) The velocity components in a two-dimensional flow are  $u = 2xy$  and  $v = a^2 + x^2 - y^2$  determine (i) Stream function (ii) Velocity Potential function **10**
- Q3** A) 250 lit/sec of water is flowing in a pipe having diameter of 300 mm if the pipe is bend by  $135^\circ$ , Find the magnitude and direction of the resultant of the force. The pressure flowing is  $39.24 \text{ N/cm}^2$ . **10**
- B) Prove this relation  $u = U_{max} \left[ 1 - \left( \frac{r}{R} \right)^2 \right]$  for the velocity distribution for laminar flow through a circular pipes. **10**
- Q4** A) Using the laminar boundary layer velocity distribution: **10**  

$$\frac{u}{U_\infty} = 2 \left( \frac{y}{\delta} \right) - 2 \left( \frac{y}{\delta} \right)^3 + \left( \frac{y}{\delta} \right)^4$$
 i) Check if boundary layer separation occurs.  
 ii) Determine Boundary layer thickness (In terms of Re)
- B) State and derive the Bernoulli's theorem and also state the assumptions made in the derivation of Bernoulli's Equation. **10**

- Q5 A)** Force acting on the propeller of an air craft depend upon the variables ,  $V$ ,  $\rho$ ,  $\mu$ ,  $D$  and  $N$  **10**  
, Deduce the formula for this force, based on Rayleigh 's method
- B)** An oil of density  $917 \text{ kg/m}^3$  is being pumped in a 15 cm diameter pipe. The discharge is measured as 850 lit/min. The drop in pressure in a stretch of 800m of pipeline, both ends which are at the same elevation, is measured as 95 kPa. Estimate the absolute viscosity of the oil. **10**
- Q6 A)** Two reservoirs whose water levels differ by 20 m are connected with a compound pipeline consisting of three pipes in series. Pipes of 200 mm diameter is connected to upper reservoir and pipe of 300 mm diameter is connected to lower reservoir. Middle pipe is 150 mm diameter. All pipes are 100 m long with friction factor 0.023, 0.024 and 0.025 respectively. Consider all losses find rate of flow of water and velocity in each pipe. **10**
- B)** Write short notes (any TWO) **10**
- 1) Reynolds experiment
  - 2) Orificemeter and Pitot tube.
  - 3) Drag and lift on an aerofoil.