Q.P. Code: 21376

(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 briefly the boundary layer formation and define boundary layer thickness. **5**

B) With neat sketch explain working and construction of a Pitot tube **5**

C) The following represent the velocity components. Calculate the unknown velocity component so that they satisfy the continuity equation. **5**

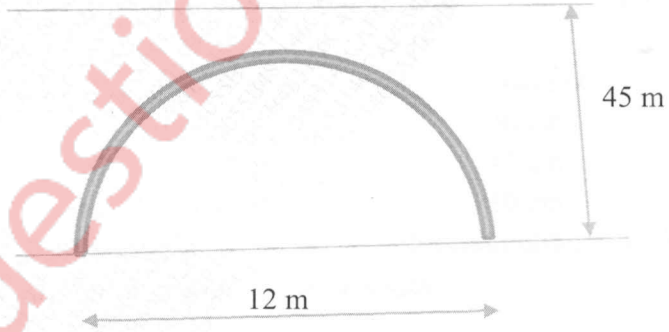
$$u = 2x^2 \quad ; \quad v = 2xyz$$

D) The absolute viscosity of a liquid having a specific gravity of 0.87 is 0.073 Poise. Find its kinematics viscosity in m^2/s and in stokes. **5**

E) Explain Stability of floating bodies. **5**

Q2 A) Derive the differential form of the general mass conservation equation in Cartesian coordinate for a fluid. **10**

B) A semicircular 12 m diameter tunnel is to be built under a 45 m deep, 240 m long lake. Determine the magnitude and direction of total hydrostatic force acting on the roof of the tunnel. **10**



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Q3 A) A 90° vertical reducing bend has a diameter 300 mm at inlet and 150 mm at exit carries 0.6 m^3/s oil of specific gravity 0.85 with a pressure of 120 KN/m^2 at inlet to the bend. The volume of bend is 0.15 m^3. Find the magnitude and direction of the force on the bend. Neglect the frictional losses and assume both inlet and outlet sections to be at same horizontal level. **10**

B) Consider a two dimensional viscous incompressible flow of a Newtonian fluid between two parallel plates, separated by a distance 'b' . One of the plates is stationary and the other is moving with a uniform velocity U. There is no pressure gradient in the flow. Obtain the general equation from the general Navier-Stokes equation. **10**

Q4 A) Using the laminar boundary layer velocity distribution: **10**

$$\frac{u}{U_\infty} = 2\left(\frac{y}{\delta}\right) - 2\left(\frac{y}{\delta}\right)^2 + \left(\frac{y}{\delta}\right)^4$$

i) Check if boundary layer separation occurs.

ii) Determine Boundary layer thickness (In terms of Re)

B) Derive Euler's equation of motion in Cartesian co-ordinate. **10**

Q5 A) Air has a velocity of 1000 km/hr at a pressure of 9.81 KN/m^2 vacuum and a temperature of 47°C. Compute its stagnation properties (Pressure, Temperature and Density). Take atm. pressure 98.1 KN/m^2, R =287 J/Kg^oK and Υ = 1.4 **10**

B) A flow has a velocity potential function as $\emptyset = x^3 - 3xy^2$. Verify whether it represents a valid flow field. If it does then determine the stream function. **10**

Q6 A) Two reservoirs are connected by three pipes in series. **10**

Pipe	Length	Diameter	f
1	500 m	30 cm	0.02
2	200 m	10 cm	0.025
3	100 m	10 cm	0.03

Calculate the discharge through them if the elevation difference of the levels is in the reservoirs is 10 m considering minor losses.

B) Write short notes (any TWO) **10**

I. Moody's Diagram

II. Lift force on circulating cylinder in uniform flow.

III. Compressible flow through the Convergent Divergent Nozzle

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