MECH/CBGS/IV/FM/01/12/16

Fluid Mechines/01/12/16

QP Code :555300

(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 Venturimeter 5

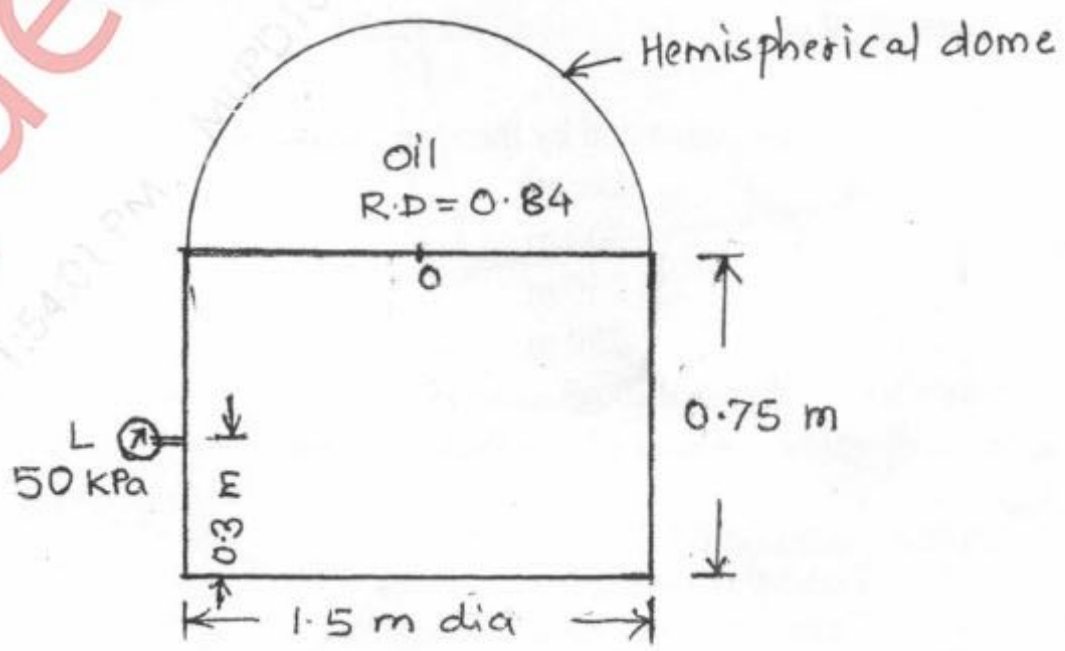
C) A two dimensional flow field is given by $u = 2y^2$, $v = 3x$. find the acceleration at point (-2,4) 5

D) A metallic body floats at the interface of mercury (Sp. gravity 13.6) and water in such a way that 30 % of its volume is submerged in mercury and 70 % in water. Find the density of the metallic body. 5

E) Define Fluid and explain types of fluid in detail 5

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

B) A cylindrical tank of 1.5 m diameter and height 0.75 m has a hemispherical dome. The tank contains oil of relative density 0.84 as shown in fig. the dome is joined to the cylinder portion by four equally spaced bolts. Determine the force on each bolt. 10



TURN OVER

Q3 A) A 0.4m x 0.3m, 90° vertical reducing bend carries 0.5 m^3/s oil of specificgravity 0.85 with a pressure of 118 KN/m^2 at inlet to the bend. The volume of bend is 0.1 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. Also assume that water enters the bend at 45° to the horizontal. 10

B) Starting from Navier-Stokes equation derive an expression for the velocity distribution for viscous flow through a circular pipe. State the assumption made and also sketch the distribution of velocity and shear stress across a section of the pipe. 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 system and from this derive Bernoulli's Equation for liquid. State assumptions made in the derivation of Bernoulli's Equation. 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 $\Upsilon = 1.4$ 10

B) A flow has a velocity potential function is given by $\emptyset = x^3 - 3xy^2$. Verify whether it represents a valid flow field. If it does then determine the stream function and calculate the velocity and pressure at (1,-3) given that pressure that the pressure at (4, 1) is 14 KPa and the fluid is water. 10

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

Pipe	Length	Diameter	f
1	300 m	30 cm	0.02
2	250 m	25cm	0.025
3	200 m	20cm	0.03

Calculate the discharge through them if the elevation difference of the levels is in the reservoirs is 20 m. consider the minor losses.

B) Write short notes (any TWO) 10

I. Prandtl's mixing length theory

II. Streamlined and Bluff bodies.

III. Compressible flow through the Convergent Divergent Nozzle

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