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10ME46B/AU46B

Fourth Semester B.E. Degree Examination, June/July 2019
Fluid Mechanics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO full questions from each part.***

PART – A

1 a. What is fluid? How do you classify them? **(05 Marks)**

b. Explain in detail the vapour pressure and cavitation. **(04 Marks)**

c. Write or derive the relationship between bulk modulus and pressure for a gas during adiabatic process. **(03 Marks)**

d. Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8m × 0.8m and inclined plane with angle 30° with horizontal. The weight of the plate is 300N and slides down on inclined plane with a uniform velocity of 0.3m/sec the thickness of oil film is 1.5mm. **(08 Marks)**

2 a. With the help of Inverted-U-tube manometer differential. Derive expression for pressure difference. **(05 Marks)**

b. Derive an expression for depth of centre of pressure from free surface of liquid of plane surface submerged in the liquid and inclined at angle 'θ' to free surface. **(08 Marks)**

c. A cylinder 3 m diameter and 4m long retains water on one side. The cylinder is supported as shown in Fig.Q.2(c). Determine the horizontal reaction at 'A' and the vertical reaction at 'B'. The cylinder weights 196 kN (Ignore friction). **(07 Marks)**

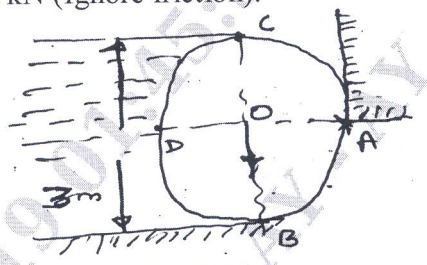

Fig.Q.2(c)

3 a. Derive an expression for determination of metacentric height theoretically. **(08 Marks)**

b. Define with equations velocity potential and stream functions. **(04 Marks)**

c. A fluid flow field is given by $V = x^2yi + y^2zj - (2xyz + yz^2)k$. Prove that it is a possible steady incompressible fluid-flow. Calculate acceleration at the point (2, 1, 3). **(08 Marks)**

4 a. While considering the equations of motion what are the forces present? **(03 Marks)**

b. Write the Euler's equation of motion. Reduce it to Bernoulli's equation and state the Bernoulli's statement. **(07 Marks)**

c. A pump has a tapering pipe running full of water the pipe is placed vertically with the diameter at the base and top being 1.2m and 0.6m respectively. The pressure at the upper end is 240mm of Hg vacuum. While lower end is 15kPa. Assume head loss to be 20% of difference of velocity head. Calculate the discharge, the flow is vertically up-words and the difference of elevation is 3.9m. **(10 Marks)**

PART – B

5 a. What is Pitot-tube? Write its velocity expression. **(03 Marks)**

b. With sketch, derive an expression for rate of flow or discharge through-ORIFICEMETER. **(07 Marks)**

c. Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust 'P' depends upon angular velocity ω, Speed of advance V, Diameter D, Dynamic viscosity μ. Mass density ρ, Elasticity of the fluid medium which can be denoted by the speed of sound in the medium C. **(10 Marks)**

6 a. With expressions discuss various minor losses. **(08 Marks)**

b. Determine the difference in the elevations between the water surfaces in the two tanks which are connected by a horizontal pipe of diameter 300mm and length 400m. The rate of flow of water through the pipe is 300 litres/sec. Consider all losses and take this value of $f = 0.008$ and also draw the HGL and TEL (Hydraulic and Total energy line). **(12 Marks)**

7 a. Derive an expression for drop in pressure head for a given length of two parallel stationary plates. **(12 Marks)**

b. An oil of viscosity 0.1 N-s/m^2 and relative density 0.9 flowing through a circular pipe of diameter 50mm and length 300m. The rate of flow of fluid through the pipe is 3.5 litres/sec. Find the drop in pressure for a length of pipe 300m and also the shear-stress at the pipe wall. **(08 Marks)**

8 a. Derive an expression for displacement thickness and energy thickness. **(10 Marks)**

b. Explain propagation of pressure waves in a compressible fluid. **(05 Marks)**

c. Find the velocity of a bullet fired in air if the mach angle is 30°. Take $R = 0.287$ kJ/kg°K, $\gamma = 1.4$ for air assume temperature as 15°C. **(05 Marks)**

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