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Reg No.:_____ Name:_____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Third Semester B.Tech Degree (S,FE) Examination January 2022 (2015 Scheme)

Course Code: ME203

Course Name: MECHANICS OF FLUIDS

Max. Marks: 100 Duration: 3 Hours

PART A

Answer any three full questions, each carries 10marks. Marks

1 a) Discuss the effect of temperature on viscosity of fluids (4)

b) An oil film of thickness 1.5 mm is used for lubrication between a square plate of size 0.9 m X 0.9 m and an inclined plane with angle of inclination 20^0. The weight of the square plate is 40 Kg and it slides down the plane with a uniform velocity of 0.2 m/sec. Find the dynamic viscosity of oil. (6)

2 a) Explain the stability conditions of floating bodies. (3)

b) A metallic body floats at the interface of mercury of specific gravity 13.6 and water in such a way that 30% of its volume submerged in mercury and remaining in water. Find the density of metallic body. (7)

3 a) Differentiate between Eulerian and Lagrangian methods of fluid flow analysis. (3)

b) For a 2 dimensional potential flow the velocity potential is given by $\varphi = 4x(3y-4)$, Find the velocity and stream function at a point (2,3). (7)

4 a) Define and explain the properties of Stream function and Velocity Potential function. (5)

b) For a 2 Dimensional flow Show that the Stream lines and Equipotential lines are orthogonal (5)

PART B

Answer any three full questions, each carries 10marks.

5 Derive three dimensional continuity equation in rectangular coordinate system (10)

6 Water is flowing through an inclined venturimeter (200 mm X 100 mm) in the upward direction. The pressure at the inlet pipe is 19.62 N/cm^2 (gauge) and at throat is 3.924 N/cm^2 (vacuum). The length between inlet and throat is 500 mm and venturimeter is inclined at an angle of 60 degrees with horizontal. Find the discharge through venturimeter. Take Cd = 0.98 (10)

7 a) Explain major and minor losses in pipes. (4)

b) A laminar flow is taking place in a pipe of diameter 200 mm. The maximum velocity is 1.5 m/sec. Find the radius at which the mean velocity occurs. Also find the velocity at 4cm from the wall of the pipe. (6)

8 a) Derive Hagen-Poiseuille Equation. (6)

b) Explain the terms water hammer and cavitation. (4)

PART C

Answer any four full questions, each carries 10marks.

9 Derive expression for Displacement Thickness and Momentum Thickness for flow over a flat plate. (10)

10 Find the expression for Displacement Thickness, Momentum thickness and Energy Thickness in terms of boundary layer thickness for the velocity distribution given as $u/U = y/\delta$. (10)

11 a) Explain the methods to prevent separation of boundary layer. (4)

b) A plate of 600 mm length and 400 mm wide is immersed in a fluid of specific gravity 0.9 and kinematic viscosity 10^{-4} m^2/sec. The fluid is moving with a velocity of 6 m/sec. Find a) Boundary Layer Thickness at the end of the plate b) Shear stress on the plate c) Drag force on one side of the plate (6)

12 Using Buckinghams Pi theorem , derive an expression for the velocity through a circular orifice if it depends on head causing the flow H, Diameter of the orifice D, Coefficient of Viscosity μ, Mass density ρ, and acceleration due to gravity g. (10)

13 a) Explain the term similitude (6)

b) Define a) Weber Number b) Euler Number (4)

14 a) Explain a) Reynolds Model law b) Froude Model Law. Explain the applications of these laws (10)

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