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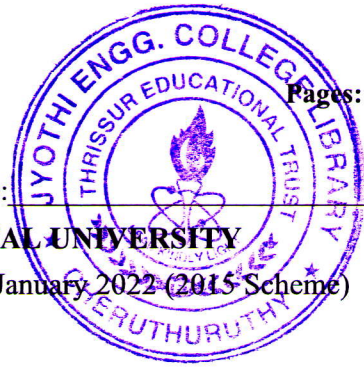
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Reg No.: _____

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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° . 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 $\phi = 4x(3y-4)$, 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 $C_d = 0.98$ (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} m²/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 Buckingham's 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)
