Hall Ticket Number:

Code No. : 13508

VASAVI COLLEGE OF ENGINEERING *(Autonomous)*, HYDERABAD

B.E. (Mech. Engg.) III Year I-Semester Main Examinations, December-2017

Mechanics of Fluids

Time: **3** hours Max. Marks: **70**

*Note: Answer **ALL** questions in **Part-A** and any **FIVE** from **Part-B***

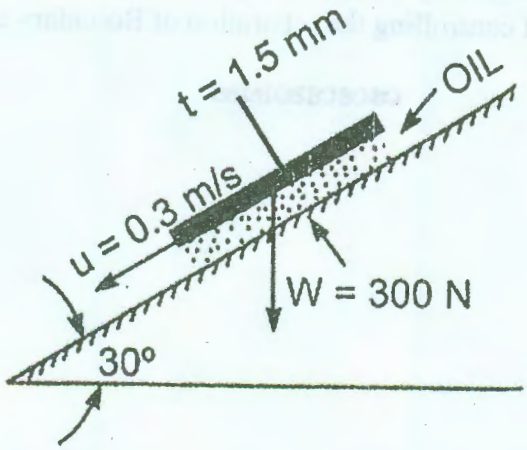
Part-A (10 × 2 = 20 Marks)

1. Sate the Pascal and Hydrostatic Law.
2. Distinguish between Dynamic viscosity and Kinematic Viscosity.
3. Explain uniform and non-uniform flow.
4. Define stream line and path line.
5. Draw a line diagram of a venturimeter and write the expression for the discharge through a venturimeter.
6. Distinguish between pitot tube and pitot static tube.
7. Explain two important characteristics of turbulent flow.
8. Define Reynolds number? Explain the effect of various parameters on Reynolds number.
9. Draw a neat sketch of boundary layer over a thin flat plate and show the regions.
10. Explain the terms hydraulic gradient and total energy lines.

Part-B (5 × 10 = 50 Marks)

11. a) Explain Newton's law of viscosity. What is the effect of temperature on viscosity of water and that of air? [4]

    b) Estimate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m x 0.8 m and an inclined plane with angle of inclination 30° as shown in figure. The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm. [6]



12. a) The velocity vector in a fluid flow is given $V=4x^3i-10x^2yj+2tk$. Evaluate the velocity and acceleration of a fluid particle at (2, 1, 3) at time t=1. [6]

    b) What conditions are necessary for potential function to exist? Explain the significance of a potential function. [4]

Contd... 2

13. a) Develop the continuity equation for a compressible fluid flow in a 3-D Cartesian coordinate system. [5]

    b) A 30cm x 15cm Venturimeter is provided in a vertical pipe line carrying oil of specific gravity 0.9, the flow being upward. The difference in elevation of the throat section and entrance section of Venturimeter is 30cm. The pressure difference in manometer is 25cm of Hg. Take C_d= 0.98. Calculate discharge of oil and pressure difference between entrance and throat. [5]

14. a) Deduce Hagen-Poiseullie equation for a laminar flow in a circular pipe and show the variation of velocity and shear stress from centre of the pipe to the wall. [5]

    b) Explain the importance of Reynold's experiment. What do you understand by lower and upper critical velocities in pipe flows? [5]

15. a) How the head loss in pipe due to friction is estimated and deduce the equation. [6]

    b) An airfoil has plan form area of 10 m^2 and travels at 200 km/hr in air of mass density 1.2 kg/m^3. If the lift and drag coefficients at a particular angle of attack are 0.8 and 0.005 respectively. Calculate (i) lift force (ii) drag force (iii) resultant force. [4]

16. a) A U-tube mercury manometer is used to measure the pressure of oil flowing through a a pipe whose specific gravity is 0.85. The centre of the pipe is 15 cm below the level of mercury. The mercury level difference in the manometer is 25 cm, determine the absolute pressure of the oil flowing through the pipe. Atmospheric pressure = 750 mm of Hg. [5]

    b) A two dimensional velocity field is given by $v = 2(x^2 - y^2)i + 4xyj$. Estimate the components of (a) the strain rates for the above velocity field (b) rotational velocity. [5]

17. Answer any ***two*** of the following:

    a) State momentum equation. How this equation is applied for determining the force exerted by a liquid on pipe bend? [5]

    b) Show that the friction factor in laminar flow is inversely proportional to the Reynold's number in case of laminar flow in circular pipes. [5]

    c) Explain the methods of controlling the separation of Boundary Layer. [5]