Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Winter 2022 - 23 Examination

Semester: 3 **Date: 11/10/2020**
Subject Code: 203120205 **Time: 02:00 pm to 04:30 pm**
Subject Name: Fluid Flow Operation **Total Marks: 60**

Instructions:
1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1 **Objective Type Questions** - (Fill in the blanks, one word answer, MCQ-not more than Five in case of MCQ) (All are compulsory) (Each of one mark) **(15)**

1. Surface tension has the units of
   (a) force per unit area b) force per unit length
   (c) force per unit volume d) none of the above
2. An ideal fluid is defined as the fluid which
   (a) is compressible (b) is incompressible
   (c) is incompressible and non-viscous (invis cid) (d) has negligible surface tension.
3. Newton's law of viscosity states that
   (a) shear stress is directly proportional to the velocity
   (b) shear stress is directly proportional to velocity gradient
   (c) shear stress is directly proportional to shear strain
   (d) shear stress is directly proportional to the viscosity
4. Stoke is the unit of
   a) surface tension
   (b) viscosity
   (e) kinematic viscosity
   (d) none of the above
5. Pascal's law states that pressure at a point is equal in all directions
   (a) in a liquid at rest
   b) in a fluid at rest
   (c) in a laminar flow
   (d) in a turbulent flow
6. The necessary condition for the flow to be steady is that
   a) the velocity does not change from place to place
   (b) the velocity is constant at a point with
   (c) the velocity changes at a point with respect to time
   (d) none of the above
7. The flow in pipe is laminar if
   (a) Reynolds number is equal to 2500
   (b) Reynolds number is equal to 4000
   (c) Reynolds number is more than 2500
   (d) none of the above
8. A stream line is a line
   (a) which is along the path of a particle
   (b) which is always parallel to the main di rection of flow
   (c) across which there is no flow
   (d) on which tangent drawn at any point gives the direction of velocity.
9. Pitot-tube is used for measurement of
   (a) pressure
   (c) velocity at a point
   (b) flow
   (d) discharge

10. What torque in Nm is required to give 3 m^3/s of water, a moment of momentum, so that it has e tangential velocity of 3 m/s at a distance of 1,8m from the axis?
    a) 16200
    (b) 157
    (c) 2624
    (d) 8138
11. One poise is equivalent to
    (a) 1 kg/m-hr
    (c) 98 dyne/sec
    (b) 1 gm/cm-sec
    (d) 68 kg-sec/m^2
12. Each term of Bernoulli's equation stated in form $P/W + V^2/2g + y$ = constant has units of
    (a) N
    (b) mN/kg
    (c) m
    (d) mN/s
13. Venturi meter is used to measure flow of fluids in pipes when pipe is:
    (a) Horizontal
    (b) Vertical, flow downwards
    (c) Vertical, flow upwards
    (d) in any position
14. The drag coefficient is defined as

    (a) $\frac{(F_D/(A))}{(\rho v_0^2)}$ (b) $\frac{(F_D/(A))}{(2\rho v_0^2)}$

    (c) $\frac{F_D}{(0.5\rho v_0^2)}$ (d) $\frac{F_D}{(0.5\rho v_0^2 A)}$

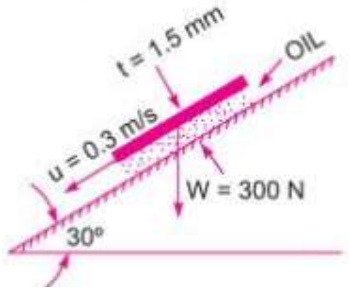
    Ans: D
15. With the same cross-sectional area and placed in the turbulent flow, the largest drag will be experienced by
    (a) a sphere
    (b) a streamlined body
    (c) a circular disc held normal to the flow direction
    (d) a circular disc held parallel to the flow direction

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Define density, weight density, specific gravity, viscosity and kinematic viscosity and also write their unit

B) Write down the types of fluids and explain with help of graph

C) Calculate 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



D) In a 100 mm diameter horizontal pipe a venturi meter of 0.5 contraction ratio has been fixed. The head of water on the meter when there is no flow is 3 m (gauge). Find the rate of flow (**liter/s)** for which the throat pressure will be 2 meters of water absolute. The co-efficient of discharge is 0.97. Take atmospheric pressure head = 10.3 m of water.

Q.3 A) Explain (i) Steady and unsteady flows; (ii) Uniform and non-uniform flows; (iii) Laminar and turbulent flows; (iv) Compressible and incompressible flows; (v) Rotational and irrotational flows; and (vi) One, two and three-dimensional flows **(07)**

The diameters of a pipe at the sections 1 and 2 are 10 cm and 15 cm respectively. **Find the discharge through** the pipe if the velocity of water flowing through the pipe at section 1 is 5 m/s. Determine also the velocity at section 2.

B) Derive the general form of Continuity equation **(08)**

OR

B) Derive the equation of stream line, the equation of the streamline passing though (1,1) for the velocity functions $V = -y^2i-6xj$ **(08)**

Q.4 A) Explain Stream lined body and Bluff Body with example **(07)**

A sub-marine which may be supposed to approximate a cylinder 4 m in diameter and 20 m long travels sub-merged at 1.3 m/s in sea-water. Find the drag exerted on it, if the drag coefficient for Reynold number greater than 10 may be taken as 0.75. The density of sea-water is given 1035 kg/m and kinematic viscosity as .015 stokes

OR

A) Derive the expression for pressure drop for turbulent flow **(07)**

B) A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 meters at a higher level. If the pressures at A and B are 9.81 N/cm² and 5.886 N/cm² respectively and the discharge is 200 liters/s determine the loss of head and direction of flow. **(08)**