Seat No: _____ Enrollment No: _____

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Winter 2022 - 23 Examination

Semester: 3 **Date: 08/10/2022**
Subject Code: 203101215 / 203101205 **Time: 2:00pm to 4:30pm**
Subject Name: Fundamentals of Fluid Mechanics **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** - All are compulsory (Each of one mark) **(15)**

1. Which of the following is a type of fluid based on viscosity?
   a) Real Fluid b) Ideal Fluid
   c) Newtonian Fluid d) All the above
2. Which among the following is an assumption of Hagen-Poiseuille equation?
   a) Fluid is uniform b) Fluid is laminar
   c) Fluid is turbulent d) Fluid is compressible
3. Which among the following have the same forces acting on them?
   a) Dynamic similarity b) Geometric similarity
   c) Conditional similarity d) Kinematic similarity
4. If a liquid enters a pipe of diameter d with a velocity v, what will its velocity at the exit if the diameter reduces to 0.5d?
   a) V b) 0.5 V
   c) 2V d) 4 V
5. What type of flow can be taken for granted in a pipe of a uniform cross-section?
   a) Steady flow b) Unsteady flow
   c) Uniform flow d) Non-Uniform flow
6. The SI unit of Dynamic Viscosity is……
7. An …… is a thermodynamic process in which there is no heat transfer from in or out of the system.
8. Moment of Inertia about an axis passing through C.G. and parallel to base (I_G) for rectangle is given by the formula……
9. A rectangular plane surface is 2 m wide and 3 m deep. Its lie on vertical plane in water. Its total pressure force on the plane surface will be ……when its upper edge is horizontal and coincide with water surface.
10. The centre of pressure h* will be …… **when $I_G = 4.5\ m^4$, $A = 6\ m^2$ and $\bar{h} = 4m$.**
11. What is the SI unit of Kinematic Viscosity?
12. Write the statement of PASCAL LAW?
13. Calculate the pressure due to column of 0.3 m of water. Take density of water as 1000 Kg/m^3
14. What is Piezometer?
15. Write the equation of gauge pressure for U-tube Manometer.

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

A) Calculate the specific weight, density, specific gravity, specific volume and mass of one liter of liquid which weighs 7N.

B) Write in detail about the different types of Fluid? Draw the graph of shear stress verses velocity gradient.

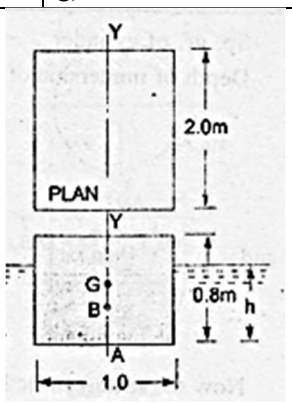
C) Calculate the capillary rise in glass tube of 2.5 mm diameter which is immersed vertically in water and mercury. Take surface tension $\sigma = 0.0725$ N/m for water and $\sigma = 0.52$ N/m for mercury in contact with air. The specific gravity of mercury is 13.6 and angle of contact is 130^0

D) Derive the equation for Hydrostatic Law with neat sketch?

Q.3 A) Define the Following **(07)**

a) Stream line	b) Path line	c) Streak line	d) Potential Line
e) Continuity equation		f) Flow net	g) Stream function

B) A block of wood of specific gravity 0.7 floats in water. Find the meta centric height of block if its size is 2m X 1m X 0.8m. **(08)**



OR

B) In a two-dimensional, incompressible flow the fluid velocity components are given by: u = x – 4y and v = -y - 4x. Show that the flow satisfies the continuity equation and obtain the expression for the stream function. If the flow is potential (irrotational) obtain also the expression for the velocity potential. **(08)**

Q.4 A) Derive the continuity equation in Cartesian coordinates. **(07)**

OR

A) Derive the momentum equation for boundary layer by Von Karman theorem. **(07)**

B) Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by propeller. Assume that the thrust P depends upon the angular velocity "w", speed of advance "V", Diameter "D", dynamic viscosity "μ", mass density "P", elasticity of fluid medium which can be denoted by the speed of sound in medium "c" given that the thrust p developed by the propeller is the function of angular velocity "w", speed of advance "V", diameter "D", dynamic viscosity "μ", mass density "p" and the velocity of sound "c". **(08)**