



## BRAINWARE UNIVERSITY

Term End Examination 2022  
 Programme – B.Tech.(ME)-2021/B.Tech.(CE)]-2021  
 Course Name – Fluid Mechanics  
 Course Code - PCC-ME303  
 ( Semester III )

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 Brainware University  
 Barasat, Kolkata -700125

Full Marks : 60

Time : 2:30 Hours

[The figure in the margin indicates full marks. Candidates are required to give their answers in their own words as far as practicable.]

### Group-A

(Multiple Choice Type Question)

1 x 15=15

1. Choose the correct alternative from the following :

- (i) A flow in which \_\_\_\_\_ force is dominating over the viscosity is called turbulent flow.
- |            |                    |
|------------|--------------------|
| a) elastic | b) surface tension |
| c) viscous | d) inertia         |
- (ii) Reynold's number is the ratio of inertia force to
- |                   |                  |
|-------------------|------------------|
| a) pressure force | b) elastic force |
| c) gravity force  | d) viscous force |
- (iii) The unit of dynamic viscosity in S.I. units is
- |                       |                       |
|-----------------------|-----------------------|
| a) N-m/s <sup>2</sup> | b) N-s/m <sup>2</sup> |
| c) poise              | d) stoke              |
- (iv) The value of bulk modulus of a fluid is required to determine
- |                     |                    |
|---------------------|--------------------|
| a) Reynold's number | b) Froude's number |
| c) Mach number      | d) Euler's number  |
- (v) The velocity corresponding to Reynold number of 2800, is called
- |                            |                             |
|----------------------------|-----------------------------|
| a) sub-sonic velocity      | b) super-sonic velocity     |
| c) lower critical velocity | d) higher critical velocity |
- (vi) Bulk modulus of a fluid \_\_\_\_\_ as the pressure increases.
- |                 |                  |
|-----------------|------------------|
| a) remains same | b) decreases     |
| c) increases    | d) None of these |
- (vii) The loss of pressure head in case of laminar flow is proportional to
- |                            |                            |
|----------------------------|----------------------------|
| a) velocity                | b) (velocity) <sup>2</sup> |
| c) (velocity) <sup>3</sup> | d) (velocity) <sup>4</sup> |
- (viii) The flow of water through the hole in the bottom of a wash basin is an example of
- |                |                  |
|----------------|------------------|
| a) steady flow | b) uniform flow  |
| c) free vortex | d) forced vortex |

- (ix) A glass tube of smaller diameter is used while performing an experiment for the capillary rise of water because
- a) it is easier to see through the glass tube      b) glass tube is cheaper than a metallic tube  
c) it is not possible to conduct this experiment with any other tube      d) all of the above
- (x) Falling drops of water become sphere due to the property of
- a) surface tension of water      b) compressibility of water  
c) capillarity of water      d) viscosity of water
- (xi) The atmospheric pressure at sea level is
- a) 103 kN/m<sup>2</sup>      b) 10.3 m of water  
c) 760 mm of mercury      d) all of these
- (xii) Which one of the following is not a unit of dynamic viscosity?
- a) Pa-s      b) N-s/m<sup>2</sup>  
c) Poise      d) Stokes
- (xiii) Which of the following machines have the possibility of cavitation?
- a) Reaction turbines and centrifugal pumps      b) Reaction turbines and reciprocating pumps  
c) Impulse turbines and centrifugal pumps      d) Impulse turbines and reciprocating pumps
- (xiv) Which of the following is a shear-thinning fluid?
- a) Bingham plastic      b) Thixotropic  
c) Dilatant      d) Pseudoplastic
- (xv) The ratio of specific weight of a liquid to the specific weight of pure water at a standard temperature is called
- a) density of liquid      b) specific gravity of liquid  
c) compressibility of liquid      d) surface tension of liquid

### Group-B

(Short Answer Type Questions)

3 x 5=15

2. A flat plate of 2 m width and 5 m length is kept parallel to air flowing at 4 m/s velocity. (3)  
Measure i) The length of the plate over which the boundary layer is laminar ii) Boundary layer thickness iii) Shear stress Take density = 1.2 kg/m<sup>3</sup> and kinematic viscosity as  $1.4 \times 10^{-5}$  m<sup>2</sup>/s.
3. What do you understand by Continuity Equation? (3)
4. Find the minimum apex angle of a solid cone of specific gravity 0.8 so that it can float in stable equilibrium in fresh water with its axis vertical and vertex downward. (3)
5. Write short note on distorted model and undistorted model. (3)
6. The density of oil is less than that of water, yet a loaded oil tanker sits lower in the water than an empty one. Why? (3)

OR

Define the term dimensional homogeneity. What are the uses of dimensional homogeneity? (3)

### Group-C

(Long Answer Type Questions)

5 x 6=30

7. List out the types of forces acting in a moving fluid and explain it briefly. (5)
8. Derive an expression for continuity for three dimensional flow and reduce it for steady, incompressible two-dimensional flow. (5)
9. Derive an expression for the difference of pressure between two points in a free vortex flow. (5)
10. Determine the total pressure and centre of pressure on an isosceles triangular plate of base 4m and altitude 4 m when it is immersed vertically in an oil of sp.gr 0.9. The base of the plate is coincides with the free surface of oil. (5)
11. Derive an expression for the depth of centre of pressure from free surface of liquid of an (5)

inclined plane surface submerged in the liquid.

12. The inlet and throat diameter of a horizontal venturimeter are 30cm and 10 cm respectively. (5)  
The Liquid flowing through the meter is water. The pressure intensity at inlet is  $13.734 \text{ N/cm}^2$ .  
While the vacuum pressure head at the throat is 37cm of mercury. Find the rate of flow.  
Assume that 4% of the differential head is lost between the inlet and throat. Find also the value of  $C_d$  for the venture meter.

OR

A 400 x 200 mm venturimeter is provided in a vertical pipe line carrying oil of relative density 0.9, the flow being upwards. The difference in elevation of the throat section and entrance section of the venturimeter is 30 cm. The differential U tube mercury manometer shows a gauge deflection of 250 mm. calculate the discharge of oil, if the coefficient of meter is 0.98. (5)

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