

## Fluid Mechanics

University of Mumbai  
Examination First Half 2022  
Program: BE Mechanical Engineering  
Curriculum Scheme: Rev-2016  
Examination: SE Semester IV

Course Code: MEC402 and Course Name: Fluid Mechanics

Time: 2 hour 30 minutes

Max.Marks:80

Q1. Multiple Choice Questions (20)	
Q1.	The square root of inertia force to viscous force is known as
Option A:	Reynolds number
Option B:	Froude number
Option C:	Nusselt number
Option D:	Prandtl Number
Q2.	Viscosity of the fluid with increase in temperature is
Option A:	Constant
Option B:	Increases
Option C:	Decreases
Option D:	No effect on viscosity
Q3.	Couette flow is the flow of fluid
Option A:	In a circular pipe of uniform cross-section
Option B:	In a circular pipe of varying cross-section
Option C:	In between fixed parallel plates separated by distance b
Option D:	In between parallel plates one moving and one fixed separated by distance b
Q4.	Force of buoyancy is the
Option A:	Weight of body
Option B:	Weight of fluid
Option C:	Weight of fluid displaced by body
Option D:	Volume of body
Q5.	Control volume system is
Option A:	One in which both mass and energy entrainment is allowed
Option B:	One in which only mass entrainment is allowed
Option C:	One in which only energy entrainment is allowed
Option D:	One in which both mass and energy not allowed
Q6.	Uniform flow is the type of flow
Option A:	In which the velocity, pressure, density are constant with respect to time
Option B:	In which the velocity, pressure, density are constant with respect to space
Option C:	In which the velocity is constant with respect to space
Option D:	In which the pressure is constant with respect to space
Q7.	Rotameter is the device used to
Option A:	Measure density of the fluid
Option B:	Measure viscosity of the fluid

Option C:	Measure discharge of the fluid
Option D:	Measure the surface tension of the fluid
Q8.	The flow is said to be irrotational if
Option A:	Rotation components are non zero
Option B:	Rotation components are zero
Option C:	If stream function exist
Option D:	Vorticity is not zero
Q9.	The discharge between two stream function lines is
Option A:	The sum of those stream function lines
Option B:	The differentiation of those stream function lines
Option C:	The multiplication of those stream function lines
Option D:	The difference of those stream function lines
Q10.	Boundary Layer thickness is the
Option A:	Distance of the plane surface over which boundary layer formed
Option B:	Vertical distance from the plane surface over which boundary layer formed
Option C:	Velocity head of the fluid in boundary layer
Option D:	Velocity gradient of the fluid inside the boundary layer

Q2. Answer any four (20)	
a	A spherical water drop of 1 mm in diameter splits up in air in 64 smaller drops of equal size. Find the work required in splitting up the drop. The surface tension coefficient of water in air is 0.073 N/m.
b	Distinguish with the help of neat sketches, between a hydro dynamically rough surface and hydro dynamically smooth surface.
c	State Newton's Law of Viscosity and classify fluids with suitable examples.
d	<p>The velocity distribution over a plate is given by</p> $u = \frac{3}{2}y - \frac{1}{2}y^2$ <p>Where, <math>u</math> = velocity, m/sec  <math>y</math> = distance from the plate boundary, m</p> <p>If the viscosity of the fluid is 8 poise find the shear stress at the plate boundary and at <math>y = 0.15</math> m from the plate.</p>
e	For the given <b>Figure 1</b> , calculate the minimum or just sufficient head $H$ in the vessel and the corresponding discharge which can pass over the plate. (Take $C_v = 1$ ; $C_d = 0.8$ )

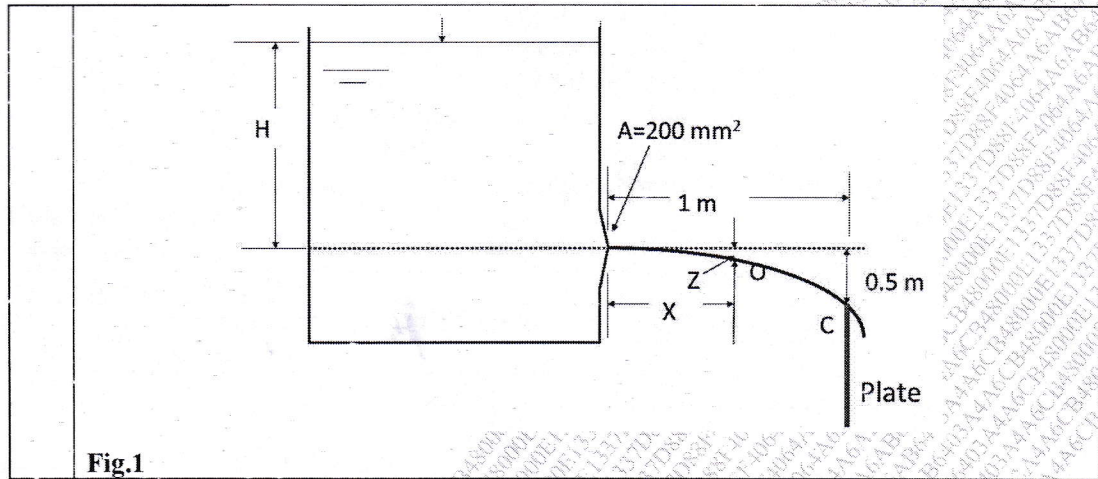


Fig.1

**Q3. Answer any two**

(20)

a) If the velocity distribution in laminar boundary layer over a flat plate is  $u = a + by + cy^2$ , determine the velocity distribution form using necessary boundary conditions and find

- Boundary Layer Thickness
- Check whether the flow is attached or not.

b) Use the appropriate form of Navier-stokes equation to derive an equation of velocity profile in plane Poiseuille flow. State assumptions made at each stage. Plot the velocity distribution curve.

c) Write short note on Moody's Chart

**Q4. Answer any two**

(20)

a) State Reynold's Transport Theorem. Using Reynold's Transport Theorem derive the mass flow rate equation and momentum equation.

b) Write short note on conditions of equilibrium for floating body and submerged body.

c) Explain the Lagrangian Approach and Eulerian approach for the fluid flow analysis. Also write their mathematical function.