Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2024

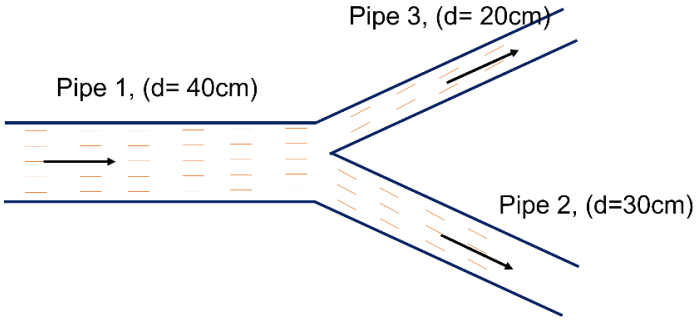
Course: Fluid Flow **Semester: III**
Program: BTech. Food Technology **Time: 03 hrs.**
Course Code: MECH 2061 **Max. Marks: 100**
No. of pages: 6
Instructions: Answer all the questions. MCQ questions may have more than one correct answer. For all the questions in section A, marks will be given only if the answer is fully correct.

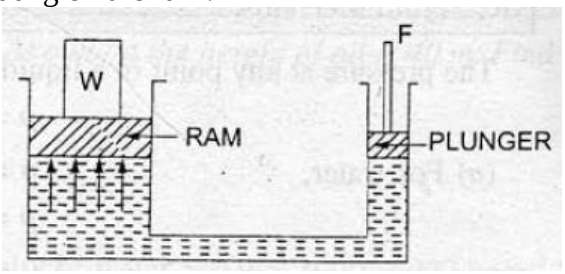
SECTION A
(20Q x 1.5M = 30Marks)

S. No.		Marks	CO
Q1	The unit of rate of shear strain is ….	**1.5**	**CO1**
Q2	Smoke coming out of a chimney is an example of a) Laminar flow b) Inviscid flow c) Unsteady flow d) Uniform flow	**1.5**	**CO1**
Q3	For the flow over a sphere, the drag force depends on a) Flow velocity b) Viscosity of the fluid c) Gravitational force d) Material density of the sphere	**1.5**	**CO1**
Q4	For a uniform flow a) Pressure remains the same at all locations b) Velocity remains the same at all the locations c) Velocity changes gradually with time d) Velocity remains constant with time	**1.5**	**CO1**
Q5	Which of the following devices is not based on Bernoulli's principle? a) Orifice meter b) Rotameter c) Venturimeter d) Pitot tube	**1.5**	**CO1**
Q6	The unit of dynamic viscosity is a) Ns b) N/m^2 c) Ns/m^2 d) Stokes	**1.5**	**CO1**

Q7	Bulk modulus is the ratio of a) shear stress to volumetric strain b) volumetric strain to shear stress c) compressive stress to volumetric strain d) volumetric strain to compressive stress	**1.5**	**CO1**
Q8	Define pump and turbine.	**1.5**	**CO1**
Q9	For a Newtonian fluid (a) Shear stress is proportional to shear strain (b) Rate of shear stress is proportional to shear strain (c) Shear stress is proportional to rate of shear strain (d) Rate of shear stress is proportional to rate of shear strain	**1.5**	**CO1**
Q10	Which of the following apparatus are not used to measure flow rate a) Orifice meter b) Venturimeter c) Falling sphere apparatus d) Rotameter	**1.5**	**CO1**
Q11	For a viscous flow through a horizontal pipe of constant diameter a) Pressure decreases with the decrease in velocity b) Pressure increases with the increase in velocity c) Pressure decreases with the increase in velocity d) Pressure does not change with the change in velocity	**1.5**	**CO2**
Q12	Skin friction drag will be zero for a) Incompressible flow b) Ideal flow c) Non-Newtonian flow d) Laminar flow	**1.5**	**CO2**
Q13	The buoyancy force on a spherical ball depends on a) Diameter of the ball b) Viscosity of the fluid c) Density of the ball material d) Density of the liquid	**1.5**	**CO2**
Q14	Bernoulli's equation deals with the law of conservation of a) mass b) flow rate c) energy d) rate of discharge	**1.5**	**CO2**

Q15	For the flow of water through a duct, the viscous force acting on the duct's wall a) Decreases with an increase in flow velocity b) Remains constant with flow velocity c) Increases with the increase in diameter of the duct d) Increases with increase in rate of discharge	**1.5**	**CO2**
Q16	The mathematical expression for the Hydrostatic law is …….	**1.5**	**CO2**
Q17	An ideal fluid is a) inviscid b) incompressible c) both inviscid and incompressible d) none of the above	**1.5**	**CO3**
Q18	Viscosity of a gas a) Increases with the increase in temperature b) Increases with the decrease in temperature c) Changes only with the change in Pressure d) Decreases with the decrease in temperature	**1.5**	**CO3**
Q19	Blood is an example of …… fluids.	**1.5**	**CO3**
Q20	Which is true for a Bingham plastic a) Shear stress is always zero b) Shear strain is always zero c) Behaves like liquid below a yield shear stress d) Behaves like a solid below a yield shear stress	**1.5**	**CO3**
SECTION B (4Qx5M= 20 Marks)			
Q1	Differentiate between a) Steady and unsteady flow b) uniform and non-uniform flow	**5**	**CO1**
Q2	With the help of examples, describe the surfaces and body forces acting on a fluid element.	**5**	**CO2**
Q3	The velocity of a fluid is given by $\mathbf{V} = (3x^2-2y)\boldsymbol{i} +2(3x+y)\boldsymbol{j}$. Calculate the magnitude of velocity and acceleration at a point (2,1,2) in the flow.	**5**	**CO2**

Q4	Calculate the buoyance force acting on a solid cube fully submerged in water. The edge length of the cube is 20mm. If the cube is made hollow, the buoyancy force acting on it will decrease or increase? Justify your answer.	**5**	**CO2**
	SECTION-C **(2Qx15M=30 Marks)**		
Q1	a) An oil is flowing through a pipe of diameter 10 cm. The flow velocity is 10 cm/s. Determine the nature of the flow (laminar or turbulent). Considering the oil as a viscous fluid, calculate the loss of pressure head between the two points in the flow at 2 meters apart. Given: specific gravity = 0.8 and viscosity coefficient = 0.5 poise. b) A 40 cm diameter pipe (pipe 1), conveying water, branches into two pipes (pipes 2 and 3) of diameter 30cm and 20cm, respectively. If the average velocity in pipe 1 is 3m/s, find the rate of discharge. Also, find the velocity in pipe 3 if the average velocity in pipe 2 is 2m/s.  [7 + 8 marks]	**15**	**CO2**
Q2	Define the following and give a few examples of each. a) Newtonian fluids b) Ideal fluids c) Bingham plastics d) Shear thickening fluids e) Shear-thinning fluids Draw the of Rheological diagram (shear stress vs velocity gradient curves) for the above materials.	**15**	**CO3**

SECTION-D (2Qx10M=20 Marks)			
Q1	a) Two plates are placed at a distance of 0.2mm apart. An oil of viscosity 5 poise is filled between the two plates. The lower plate is fixed, while the upper plate is pulled at a constant velocity of 0.2 m/s. The surface area of the upper plate is 5 m^2. Calculate the force required to pull the upper plate with constant velocity. b) If a hydraulic press has a ram of 10 cm diameter and plunger of 2.5 cm diameter. What force would be required on the plunger to lift a mass of 500kg on the ram?  [5+5 marks]	**10**	**CO2**
Q2	a) What is viscosity and viscometer? [2 Marks] b) Write the Stoke's law. Calculate the drag force acting on a spherical ball falling in a tank filled with oil at a constant velocity of 1 m/s. The diameter of the ball is 20 mm, and the viscosity of the oil is 0.3 Ns/m^2. Also, calculate the value of the Drag coefficient. [8 Marks]	**10**	**CO3**