Name: **Enrolment No:**	

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2023

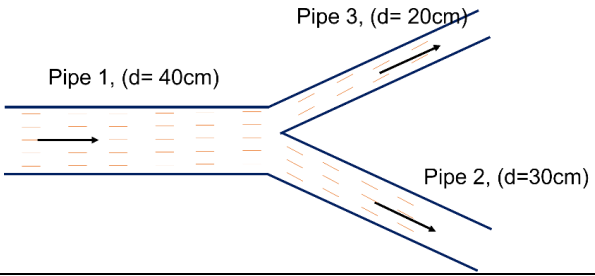
Course: Fluid Flow **Semester: III**
Program: BTech. Food Technology **Time: 03 hrs.**
Course Code: MECH 2033 **Max. Marks: 100**
No. of pages: 5
Instructions: Answer all the questions

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

S. No.		Marks	CO
Q1	Write the units and dimensions of acceleration	**1.5**	**CO1**
Q2	The smoke coming out of an industrial chimney is an example of a) Laminar flow b) Uniform flow c) Turbulent and steady flow d) Turbulent and unsteady flow	**1.5**	**CO1**
Q3	Which of the following is not a unit of pressure a) Pa b) kPa c) N/m^2 d) bar e) Ns/m^2	**1.5**	**CO1**
Q4	Rotameter is a devise used for measuring a) Viscosity of a liquid b) Fluid Pressure c) Flow rate d) Flow Velocity	**1.5**	**CO2**
Q5	For a compressible flow a) Pressure remains constant b) Temperature remains constant c) Density remains constant d) Velocity remains constant	**1.5**	**CO1**

Q6	For a steady flow a) Pressure remains same at all the locations b) Velocity remains same at all the locations c) Velocity changes with gradually time d) Velocity remains constant with time	**1.5**	**CO1**
Q7	100 stokes is equal to a) 0.0001 m^2/s b) 0.001 m^2/s c) 0.01 m^2/s d) 0.1 m^2/s	**1.5**	**CO1**
Q8	The unit of dynamic viscosity is a) Ns b) N/m^2 c) Ns/m^2 d) Stokes	**1.5**	**CO1**
Q9	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**
Q10	What is the correct formula for absolute pressure? a). Pabs = Patm – Pgauge b). Pabs = Pvacuum – Patm c). Pabs = Pvacuum + Patm d). Pabs = Patm+ Pgauge	**1.5**	**CO1**
Q11	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**
Q12	For the flow through a horizontal duct 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**

Q13	Skin friction drag will be zero for a) Incompressible flow b) Ideal flow c) Non-Newtonian flow d) Laminar flow	**1.5**	**CO2**
Q14	Pitot tube is used for the measurement of a) Pressure b) Density c) Flow rate d) Flow velocity at a point	**1.5**	**CO2**
Q15	Bernoulli's equation is deals with the law of conservation of a) mass b) flow rate c) energy d) rate of discharge	**1.5**	**CO2**
Q16	For the flow of water through a duct, the viscous force acting on the duct's wall a) Decreases with 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**
Q17	Write down the continuity equation for a compressible flow	**1.5**	**CO3**
Q18	An ideal fluid is a) inviscid b) incompressible c) both inviscid and incompressible d) none of the above	**1.5**	**CO3**
Q19	Viscosity of a liquid is measured using a) Barometer b) Venturimeter c) Pitot-static tube d) Capillary tube method	**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) Newtonian and non-Newtonian fluid, b) Steady and unsteady flow	**5**	**CO1**
Q2	Define Reynolds Number. Write down its mathematical expression and its physical significance.	**5**	**CO2**
Q3	A pitot-static tube is used to measure air velocity. If manometer connected to the instrument shows a difference of 5 mm of water head between the total and static tubes. Calculate the air velocity assuming the density of air is 1.2 kg/m^3.	**5**	**CO2**
Q4	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.  	**5**	**CO3**
SECTION-C **(2Qx15M=30 Marks)**			
Q1	In a food processing unit, hot Canola oil is flowing through a circular pipe (diameter 5 cm) at a velocity of 1.5 m/s. Given: density of the oil is 750 kg/m^3 and the dynamic viscosity is 7.5×10^{-3} Ns/m^2. [3 ×5 marks] a) Calculate the flow rate or rate of discharge through the pipe. b) The total volume and mass of oil supplied through the pipe in 10 minutes. c) Calculate the Reynolds number of the flow. And comment about the nature of the flow through the pipe i.e., is this a laminar flow or a turbulent flow. Your comments should be based on numerical analysis.	**15**	**CO2**

Q2	a) Write the Stoke's law. Calculate the drag force acting on a spherical ball falling in a tank filled with an oil at a constant velocity of 1 m/s. The diameter of the ball is 20 mm, viscosity of the oil is 0.3 Ns/m^2 b) Discuss an experimental method of measuring viscosity of a liquid. [10 + 5 Marks]	**15**	**CO3**
SECTION-D **(2Qx10M=20 Marks)**			
Q1	a) What are different sources of energy losses in a flow through a pipe? b) An oil is flowing through a pipe of diameter 10 cm. The flow velocity is 10 cm/s. Considering the oil as a viscous fluid, calculate of loss of pressure head between the two pints in the flow at 2 meters apart. Given: specific gravity = 0.8 and viscosity coefficient = 0.5 poise [3 + 7 Marks]	**10**	**CO2**
Q2	Write a short note on the followings: a) Bingham Plastics b) Shear thinning c) Shear thickening d) Thixotropic fluids e) Antithixotropic (or rheopectic) fluids	**10**	**CO3**