Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

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

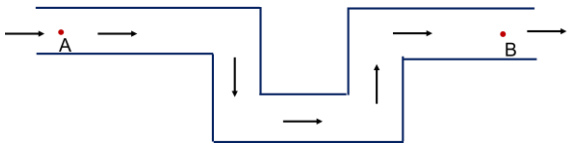
SECTION A
(20Q x 1.5M = 30Marks)

S. No.		Marks	CO
Q1	The unit of shear strain is a) N/m^2 b) m/s c) unit less d) Pa	**1.5**	**CO1**
Q2	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**
Q3	For a compressible flow a) Pressure remains constant b) Temperature remains constant c) Density remains constant d) Velocity remains constant	**1.5**	**CO1**
Q4	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**
Q5	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**

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	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**
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	The pressure at a point in a fluid will not be same in all directions when the fluid is a) Moving b) Viscous c) Viscous and static d) Viscous and moving	**1.5**	**CO1**
Q11	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**
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	Pitot tube is used for the measurement of a) Pressure b) Density c) Flow rate d) Flow velocity at a point	**1.5**	**CO2**
Q14	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**
Q15	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**
Q16	The mathematical expression for the Hydrostatic law is …….	**1.5**	**CO3**
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 liquid a) Increases with the increase in temperature b) Increases with the decrease in temperature c) Changes only with change in Pressure d) Decreases with the decrease in temperature	**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) Compressible and incompressible flow	**5**	**CO1**
Q2	Define Reynolds Number. Write down its mathematical expression and its physical significance.	**5**	**CO2**
Q3	What are the different sources of energy losses in a pipe flow? Explain in detail.	**5**	**CO2**
Q4	Why the viscosity of liquids decreases with increase in temperature and the viscosity of gases increases with the increase in temperature?	**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	Define the followings 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	Water is flowing through a horizontal circular pipe. You are required to calculate the loss of energy head between the two points A and B, as shown in figure. Given: Pressure and velocity at point A are 12kPa and 5m/s; Pressure and velocity at point B are 10kPa and 4 m/s.  	**10**	**CO2**
Q2	The velocity distribution for flow over a flat plate is given by $u = (3y - 4y^2)$, where u is the velocity (in m/s) at a distance y meter above the plate. Determine the shear stress at y = 10 cm. Also, calculate the wall shear stress and shear force (per unit area) acting on the plate. The viscosity of the liquid is 0.8 poise.	**10**	**CO2**