


Name:			
Enrolment No:			
UNIVERSITY OF PETROLEUM AND ENERGY STUDIES End Semester Examination, May 2022			
Course: Introduction to Fluid Mechanics Program: B Tech Civil Engineering Course Code: CIVL 2006		Semester: IV Time: 03 hrs. Max. Marks: 100	
Instructions: Attempt all the question			
Set-1			
SECTION A (5Qx4M=20Marks)			
S. No.		Marks	CO
Q 1	Compare the variation of viscosity vs rate of shear strain for toothpaste and blood.	4	CO1
Q 2	Assertion (A): Streamlines can cross one another if the fluid has higher velocity. Reason (R): At sufficiently high velocity, the Reynolds number is high and at sufficiently high Reynolds numbers, the structure of the flow is turbulent type.	4	CO2
Q 3	The velocity of a water stream is being measured by a L-shaped Pilot tube and the reading is 20 cm. Then what is the approximate value of velocity?	4	CO3
Q 4	The Reynolds number for flow of a certain fluid in a circular tube is specified as 2500. What will be the Reynolds number when the tube diameter is increased by 20% and the fluid velocity is decreased by 40% keeping fluid the same?	4	CO4
Q 5	In a fluid machine, the relevant parameters are volume flow rate, density, viscosity, bulk modulus, pressure difference, power consumption, rotational speed and characteristic dimension. Using the Buckingham pi (π) theorem, what would be the number of independent non-dimensional groups? Also specify the repeating variables that will be selected for the analysis.	4	CO4
SECTION B (4Qx10M= 40 Marks)			
Q 6	A 120 mm disc rotates on a table separated by an oil film of 1.8 mm thickness. Find the viscosity of the oil if the torque required to rotate the disc at 60 rpm is 3.6×10^{-4} N/m.	10	CO1
Q 7	A fluid of absolute viscosity 8 poise flows past a flat plate and has a velocity 1 m/s at the vertex, which is at 0.2m from the plate surface. Make calculations for the shear stress at points 0.05, 0.1, and 0.15m	10	CO1

	from the boundary. Assume a) Straight line velocity distribution b) Parabolic velocity distribution		
Q 8	What is the principle behind the working of pitot tube? Derive the expression for the measurement of the velocity. Also, explain pitot static tube.	10	CO3
OR			
Q 8	A Venturimeter of 40mm throat diameter is fitted in a horizontal pipe of 80mm diameter. The pressure difference between the pipe and the throat is 60 KPa. Water is flowing through the pipe. Find the velocity in the pipe.	10	CO3
Q 9	The water flowing through a pipe having diameters 20cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 lps. The section 1 is 6m above datum and section 2 is 4m above datum. If the pressure at section 1 is 39.24 N/cm ² , find pressure at section 2.	10	CO3
SECTION-C (2Qx20M=40 Marks)			
Q 10	The pressure difference Δp in a pipe of diameter and length l due to turbulent flow depends upon the velocity V , viscosity μ , density ρ and roughness k . Using Buckingham theorem, obtain the expression for Δp	20	CO4
OR			
Q 10	A Test was made on a pipe model 15mm in diameter and 3m long with water flowing through it at the corresponding speed for frictional resistance. The head loss was found by measurement to be 7 m of water. The prototype pipe is 300mm in diameter and 240m long through which air is flowing at 3.6m/s. Density of water and air are 1000kg/m ³ . And the coefficients of viscosity of water and air are 0.01 and 1.8x10 ⁻⁴ poise respectively. Find a) The corresponding speed of water in the model pipe for the dynamic similarity b) Pressure drop in prototype pipe.	20	CO4
Q 11)	a) A 2-D field is given as : $\phi = 3xy$ Determine 1. Stream function 2. Velocity at L(2,6) and M(6,6) and the pressure difference between the points L and M. 3. The discharge between the streamlines passing through points L and M. b) Flow field is given as $V = (5x+6y+7z)i+(6x+5y+9z)j+(3x+2y+\beta z)k$ and density varies as $\rho=\rho_0e^{-2t}$ in an order that the mass is conserved. Find the value of β .	10+10	CO2