GUJARAT TECHNOLOGICAL UNIVERSITY
BE - SEMESTER–IV EXAMINATION – SUMMER 2025

Subject Code: 3140110   **Date:08-05-2025**

Subject Name: Fluid Mechanics

Time: 10:30 AM TO 01:00 PM   **Total Marks:70**

Instructions:
1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Simple and non-programmable scientific calculators are allowed.**

			Marks
Q.1	**(a)**	Define the following fluid properties: a) Density b) Viscosity c) Specific Volume	**03**
	(b)	If 5 m³ of a certain oil weigh 40 kN, calculate the specific weight, mass density and specific gravity of this oil.	**04**
	(c)	A cubical block of 20 cm edge and weight 20 N is allowed to slide down a plane inclined at 20° to the horizontal on which there is thin film of oil of viscosity 0.22×10^{-3} N-s/m². What terminal velocity will be attained by the block if the fill thickness is estimated to be 0.025 mm?	**07**
Q.2	**(a)**	Find the depth of a point below water surface in sea where pressure intensity is 1.006 MN/m². Specific gravity of sea water = 1.025.	**03**
	(b)	Prove that the pressure is the same in all directions at a point in a static fluid.	**04**
	(c)	Derive an expression for the force exerted on a submerged vertical plane surface by the static fluid and locate the position of center of pressure.	**07**

OR

	(c)	Describe briefly the experimental method of determination of the metacentric height of a floating object.	**07**
Q.3	**(a)**	Define: Streamline, Path line and streak line in a fluid flow.	**03**
	(b)	A stream function is given by $\psi = 3x^2 - y^3$. Determine the magnitude of velocity components at the point (2,1)	**04**
	(c)	State and derive Bernoulli's theorem, mentioning clearly the assumptions underlying it.	**07**

OR

Q.3	**(a)**	Distinguish between laminar flow and turbulent flow.	**03**
	(b)	A 0.5 m diameter pipe carries oil of specific gravity 0.8 at the rate of 120 litres per second and the gauge pressure at a point A is 19.62 kN/m². If the point A is 3.5 m above the datum line, calculate the total energy at point A in metres of oil.	**04**
	(c)	Derive an expression for continuity equation for three-dimensional fluid flow in cartesian system.	**07**

Q.4	**(a)**	What is meant by geometric, kinematic and dynamic similarities?	**03**
	(b)	Define following dimensionless numbers:	
		1) Reynold's Number	**04**
		2) Mach Number	
	(c)	Describe the Rayleigh's Method for dimensional analysis with example.	**07**

OR

Q.4	**(a)**	Define the Terms:	
		1) Lift	
		2) Drag	**03**
		3) Terminal Velocity	
	(b)	Explain the terms:	
		1) Hydraulic Gradient Line	**04**
		2) Total Energy Line	
	(c)	For Laminar flow of an oil having dynamic viscosity $\mu = 1.766$ Pa-s in a 0.3 m diameter pipe, the velocity distribution is parabolic with a maximum point velocity of 3 m/s at the centre of the pipe. Calculate the shearing stresses at the pipe wall and within the fluid 50 mm from the pipe wall.	**07**

Q.5	**(a)**	Explain working of pitot tube.	**03**
	(b)	What do you understand by Major and Minor energy losses in pipe flow?	**04**
	(c)	What is meant by water hammer? Obtain an expression for the rise in pressure in a thin elastic pipe of circular section in which the flow of water is stopped by sudden closure of valve.	**07**

OR

Q.5	**(a)**	What you do understand by Coutte flow?	**03**
	(b)	Define Kinetic energy correction factor.	**04**
	(c)	Define displacement thickness. Derive an expression for displacement thickness.	**07**