

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-IV (NEW) EXAMINATION – SUMMER 2024****Subject Code:2141906****Date:20-07-2024****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: (1) Weight density (2) specific volume (3) specific gravity of a fluid.	03
	(b) State and prove the Pascal's Law.	04
	(c) What are the conditions of equilibrium of a floating body and a sub-merged body?	07
Q.2	(a) State the Newton's law of viscosity and give examples of its applications.	03
	(b) Define velocity potential function and stream function.	04
	(c) A U-tube manometer is used to measure the pressure of water in a pipe line, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb. Determine the pressure of water in the main line, if the difference in level of mercury in the limb of U-tube is 10 cm and the free surface of mercury is in level with the centre of the pipe. If the pressure of water in pipe line is reduced to 9810 N/m ² , calculate the new difference in the level of mercury. Refer Figure-1	07
	OR	
	(c) Derive an expression for the force exerted on a sub-merged vertical plane surface by the static liquid and locate the position of centre of pressure.	07
Q.3	(a) Explain the terms 'meta-centre' and 'metacentric-height'.	03
	(b) Explain the principle of venturimeter with a neat sketch. What is coefficient of discharge (Cd)? How to calculate Cd?	04
	(c) The following cases represent the two velocity components, determine the third component of velocity such that they satisfy the continuity equation: (i) $u = x^2 + y^2 + z^2$; $v = xy^2 - yz^2 + xy$ (ii) $v = 2y^2$; $w = 2xyz$	07
	OR	
Q.3	(a) What is the application of Pitot tube? Explain with neat sketch.	03
	(b) The water is flowing through a pipe having diameters 25 cm and 12 cm at section 1 and 2 respectively. The rate of flow through pipe is 40 litres/s. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 40 N/cm ² , find the intensity of pressure at section 2.	04
	(c) Derive Euler's equation of motion. How will you obtain Bernoulli's equation from it?	07
Q.4	(a) Define the terms: (i) Kinematic viscosity (ii) velocity gradient (iii) pressure gradient.	03
	(b) Define the following: (i) steady flow (ii) non-uniform flow (iii) Laminar flow (iv) Two-dimensional flow.	04

- (c) What is meant by geometric, kinematic and dynamic similarities? Are these similarities truly attainable? If not why? **07**
- OR**
- Q.4** (a) Describe Reynold's experiments to demonstrate the two types of flow. **03**
 (b) Explain briefly Undistorted and Distorted hydraulic models. **04**
 (c) Enlist different methods of determination of coefficient of viscosity. **07**
 Explain any one in details.
- Q.5** (a) What do you understand by the terms: Major energy losses and Minor energy losses in pipes? **03**
 (b) Calculate the discharge through a pipe of diameter 200 mm when the difference of pressure head between the two ends of a pipe 500 m apart is 4 m of water. Take the value of $f = 0.009$ in the formula $h_f = \frac{4fLV^2}{2gd}$ **04**
 (c) Derive Darcy-Weisbach equation. **07**
- OR**
- Q.5** (a) Explain flow through syphon with neat diagram. **03**
 (b) Define the terms: (i) Sonic flow (ii) supersonic flow (iii) Mach number (iv) Mach cone. **04**
 (c) Prove that the velocity through nozzle is given by **07**

$$v = \sqrt{\frac{2gH}{1 + \frac{4fL}{D} \times \frac{a^2}{A^2}}}$$

where, a=Area of nozzle at outlet, A=Area of pipe

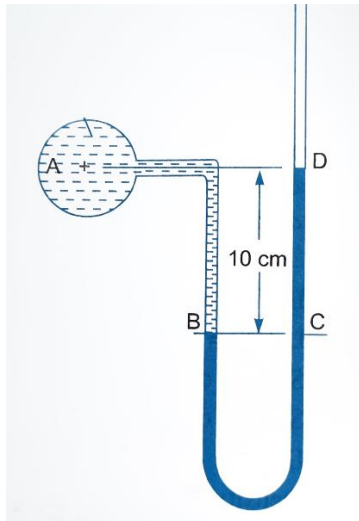


Figure-1
