Sub Code: R2321014 **R23** **Set No. 1**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURAJADA VIZINAGARAM
II B. Tech I Semester Regular/Supply Examinations, November – 2025
FLUID MECHANICS
(CIVIL ENGINEERING)

Time: 3 hours **Max. Marks: 70**

Question paper consists of Part A, Part B.
Part A is compulsory, Answer all questions.
In Part B, Answer any one question from each unit.

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PART-A **(20 Marks)**

1	a)	Define Kinematic viscosity and dynamic viscosity	[2]
	b)	Define Bulk modulus of elasticity and compressibility	[2]
	c)	Define U-tube differential manometer and Micro-manometer	[2]
	d)	Define Buoyancy and center of buoyancy	[2]
	e)	Define Laminar flow and Turbulent flow	[2]
	f)	Define rotational and irrotational flows.	[2]
	g)	Write Navier-Stokes equation and Euler`s equation of motion in-terms of forces present in the fluid flow	[2]
	h)	What is the difference between Venturimeter and Flow Nozzle meter?.	[2]
	i)	Write the Laws of fluid friction for Laminar flow.	[2]
	j)	Define momentum correction factor and write it`s equation	[2]

PART-B **(50 Marks)**

Unit-1

2	a)	Define kinematic viscosity and dynamic viscosity. Show that shear stress is proportional to the velocity gradient.	[5]
	b)	A plate 0.025mm distant from a fixed plate, moves at 61 cm/sec and requires a force of 0.25 kg(*f*)/m^2 to maintain this speed. Determine the dynamic viscosity of the fluid between the plates.	[5]

(OR)

3	a)	Define surface tension and capillarity. Derive the expression for the capillary rise(depression) '*h*' of a liquid of specific weight '*w*' in a tube of radius '*r*'.	[5]
	b)	Calculate the capillary rise in a glass tube of 2mm diameter when immersed in water. The surface tension of water at 20^0 is 0.0075kg(f)/m.	[5]

Unit-2

4	a)	Distinguish between U-tube differential manometers and inverted U-tube differential manometers. Discuss its application.	[5]
	b)	What is Pascal`s Law?. Show that The pressure at any point in a fluid at rest has the same magnitude in all directions.	[5]

(OR)

5	a)	Derive the equation for the position of center of pressure on a plane surface immersed vertically in a static mass of liquid.	[5]
	b)	A vertical gate closes a horizontal tunnel 4 m high and 1.75 m wide running full with water. The pressure at the bottom of the gate is 180 kN/m^2. Determine the total pressure on the gate and position of the centre of pressure.	[5]

Unit-3

6	a)	Explain the terms (i) Path line (ii) Streak line (iii) Stream line and (iv) Stream tube.	[5]
	b)	Distinguish between (i) Steady and unsteady flow (ii) Uniform and Non-uniform flow (iii) Rotational and Irrotational flow	[5]

(OR)

7	a)	Derive the continuity equation in Cartesian coordinates for one-dimensional flow	[5]
	b)	When 2000 liters of water flows per minute through a 0.3 diameter pipe which later reduces to a 0.10 diameter pipe, calculate the velocities of flow in the two pipes.	[5]

Unit-4

8	a)	Derive an expression for Bernoulli`s equation from first principle and state the assumptions made for the derivation.	[5]
	b)	The water is flowing through a pipe having diameters 200mm and 100mm at sections 1 and 2 respectively. The rate of flow through pipe is 30 liters per second. The section 1 is 5m above datum and section 2 is 3.5m above the datum. If the pressure at section 1 is 35 N/cm^2, find the intensity of pressure at section 2.	[5]

(OR)

9	a)	Define (i) Reynolds number (ii) Froude number, (iii) Mach number (iv) Weber number (v) Euler number	[5]
	b)	A horizontal venturimeter with inlet diameter 20cm and throat diameter 9cm is used to measure the flow of water. The pressure at inlet is 14 N/cm^2 and vacuum pressure at the throat is 35cm of mercury. Find the discharge of water through venturirmeter.	[5]

Unit-5

10	a)	Derive the equation for energy loss in pipes due to friction. Mention the assumptions	[5]
	b)	A pipeline 0.20 m in diameter and 1500 m long has a slope of 1 in 200 for the first 750 m and 1 in 100 for the next 750 m. The pressure at the upper end of the pipeline is 100 kPa and at the lower end is 54 kPa.. Taking $f = 0.032$ determine the discharge through the pipe.	[5]

(OR)

11	a)	Explain with diagram the Hydraulic Grade Line (HGL) and Total Energy Line (TEL)	[5]
	b)	A compound pipe system consists of 1500m of 0.40m, 1100m of 0.30m and 500m of 0.20m new cast iron pipes connected in series. Convert the system to (i) an equivalent length of 0.30m and (ii) equivalent size pipe 2000m long.	[5]

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