USN [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ] **BCV402**

Fourth Semester B.E./B.Tech. Degree Examination, June/July 2025
Fluid Mechanics and Hydraulics

Time: 3 hrs.   Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.

		Module – 1	M	L	C
Q.1	a.	Define the following and mention their units: i) Capillarity ii) Surface tension (iii) Viscosity	06	L2	CO1
	b.	Calculate the density, specific weight and weight of one litre of petrol of specify gravity = 0.7	06	L3	CO1

	c.	The space between two square flat parallel plates is filled with oil. Each side of the plate is 60 cm. The thickness of the oil film is 12.5 mm. The upper plate, which moves at 2.5 meter per sec requires a force of 98.1 N to maintain the speed. Determine
		   (i) The dynamic viscosity of the oil in poise
		   (ii) The kinematic viscosity of the oil in stokes if the specific gravity of the oil is 0.95.
			08	L3	CO1

		OR			
Q.2	a.	State and prove Pascal's law.	06	L2	CO1

	b.	An open tank contains water upto a depth of 2 m and above if an oil of sp. gr. 0.9 for a depth of 1 m. Find the pressure intensity
		   (i) at the interface of the two liquids
		   (ii) at the bottom of the tank.
			06	L3	CO1

	c.	A differential manometer is connected the two points A and B of two pipes as shown in Fig.Q2(c). The pipe A contains a liquid of sp.gr. = 1.5. While pipe B contains a liquid of sp. gr. = 0.9. The pressure at A and B are 1 kgf/cm^2 and 1.80 kgf/cm^2 respectively. Find the difference in mercury level in the differential manometer. Fig.Q2(c)	08	L3	CO1

Module – 2

Q.3	a.	Derive the expression for Euler's equation of motion.	08	L2	CO2
	b.	Water is flowing through a pipe having diameter 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.525 N/cm^2 and pressure at the upper end is 9.81 N/cm^2. Determine the difference in datum head if the rate of flow through pipe is 40 lt/s.	08	L4	CO2
	c.	List the assumption made in the derivation of Bernoulli's equation.	04	L2	CO2
		OR			
Q.4	a.	Derive the equation for discharge through venturimeter. Explain with neat sketch.	08	L2	CO2
	b.	An orifice meter with orifie diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauge fitted upstream and downstream of the orifice meter gives reading of 19.62 N/cm^2 and 9.81 N/cm^2 respectively. Coefficient of discharge for the meter is given as 0.6. Find the discharge of water through pipe.	06	L4	CO2
	c.	A pitot-static tube placed in the centre of a 300 mm pipeline has one orifice pointing upstream and other perpendicular to it. The mean velocity in the pipe is 0.80 of the central velocity. Find the discharge through the pipe if the pressure difference between the two orifices is 60 mm of water. Take the coefficient of pitot tube as $C_v = 0.98$.	06	L4	CO2

Module – 3

Q.5	a.	Define hydraulic coefficients for an orifice and give the relation between them.	06	L2	CO3
	b.	Find the discharge from a 100 mm diameter external mouth piece, fitted to a side of a large vessel if the head over the mouth piece is 4 meters.	06	L4	CO3
	c.	Derive the expression for discharge through a triangular notch.	08	L2	CO3
		OR			
Q.6	a.	Derive Darcy – Weisbach equation for head loss due to friction in a pipe.	08	L2	CO3
	b.	List the any four minor losses in a pipe flow with expression.	06	L2	CO3
	c.	Write the short notes on the following : i) Pipes in series ii) Equivalent pipe iii) Pipes in parallel	06	L2	CO3

Module – 4

Q.7	a.	Distinguish between (i) Gradually varied flow and rapidly varied flow (ii) Total energy and specific energy (iii) Subcritical and super critical flow	06	L2	CO4

Q.7	b.	A rectangular channel is 2.5 m wide and has a uniform bed slope of 1 in 500. If the depth of flow is constant 1.7 m. Calculate (i) The hydraulic mean depth (ii) The velocity of flow (iii) The volume rate of flow Assume that the value of the coefficient C in Chezy's formula is 50.	06	L3	CO4
	c.	Determine the most efficient section of a trapezoidal channel with side slope of 1 vertical to 2 horizontal. The channel carries a discharge of 11.25 m^3/s with a velocity of 0.75 m/s. What should be the bed slope of the channel? Take Mannings n = 0.025 .	08	L3	CO4
OR					
Q.8	a.	Derive Chezy's equation for uniform rate of flow in a channel.	08	L2	CO4
	b.	For most economical rectangular channel prove that half of the width equal to depth of flow in channel.	06	L3	CO4
	c.	Explain critical depth and critical velocity.	06	L2	CO4
Module – 5					
Q.9	a.	State Impulse - Momentum equation. Give its application.	06	L2	CO5
	b.	A 75 mm diameter water jet having a velocity of 30 m/s strikes a flat plate, the normal of which is inclined at 45° to the axis of the jet. Find the normal pressure on the plate, when the plate is moving with a velocity of 15 m/s and away from the jet, the normal force on the plate.	06	L4	CO5
	c.	A jet of water of diameter 7.5 cm strikes a curved plate at its centre with a velocity of 20 m/s. The curved plate is moving with a velocity of 8 m/s in the direction of jet. The jet is deflected through an angle of 165°. Assuming the plate smooth find: (i) Force exerted on the plate in the direction of jet. (ii) Power of the jet (iii) Efficiency of the jet	08	L4	CO5
OR					
Q.10	a.	Explain various efficiency of centrifugal pump.	06	L2	CO5
	b.	List the difference between Impulse and Reaction turbine.	06	L2	CO5
	c.	Explain classification and types of turbines.	08	L2	CO5

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