CBCS SCHEME

USN 1 A Y 2 1 A U 0 0 1

BAU403

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

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 fluid properties: i) Density ii) Weight density, iii) Specific volume iv) Specific gravity v) Viscosity	10	L1	CO1
	b.	A vertical gap 2.2 cm wide of infinite extent contains a fluid of viscosity 2.0 Ns/m^2 and specific gravity 0.9. A metallic plate 1.2 m × 1.2 m × 0.2 cm is to be lifted up with a constant velocity of 0.15 m/sec, through the gap. If the plate is in the middle of the gap, find the force required. The weight of the plate is 40 N.	10	L3	CO1
		OR			
Q.2	a.	State and prove the Pascal's law.	10	L1	CO1
	b.	A pipe line which is 4 m in diameter contains a gate valve. The pressure at the centre of the pipe is 19.6 N/cm^2. If the pipe is filled with oil of specific gravity 0.87, find the force exerted by the oil upon the gate and position of centre of pressure.	10	L3	CO1
		Module – 2			
Q.3	a.	Explain the method to find the metacentric height analytically.	10	L2	CO2
	b.	A solid cylinder of diameter 4 m has a height of 3 metres. Find the metacentric height of the cylinder when it is floating in water with its axis vertical. The specific gravity of the cylinder = 0.6.	10	L2	CO2
		OR			
Q.4	a.	Obtain an expression for continuity equation for a three-dimensional steady incompressible flow.	10	L2	CO2
	b.	Illustrate that, for potential flow, both the stream function and velocity potential function satisfy the Laplace equation.	10	L3	CO2
		Module – 3			
Q.5	a.	Prove Bernoulli's equation starting from on fundamental and state all the assumptions made.	10	L2	CO3

	b.	The water is flowing through a pipe having diameters 20 cm and 10 cm at sections 1 and 2 respectively. The rate of flow through pipe is 35 litres/sec. The section 1 is 6 m above datum and section 2 is 4 m above datum. If the pressure at section 1 is 39.24 N/cm^2. Find the intensity of pressure at section 2.	10	L4	CO3
		OR			
Q.6	a.	With a neat sketch, explain the working of a pitot tube and derive an expression to determine the actual velocity of a stream.	10	L2	CO3
	b.	A horizontal venturimeter with inlet diameter 20 cm and throat diameter 10 cm is used to measure the flow of water. The pressure at inlet is 17.658 N/cm^2 and the vacuum pressure at the throat is 30 cm of mercury. Find the discharge of water through venturimeter. Take $C_d = 0.98$.	10	L4	CO3
		Module – 4			
Q.7	a.	How to determine the loss of head due to friction in pipes by using: i) Darcy formula ii) Chezy formula.	10	L1	CO4
	b.	Explain the terms: i) Major energy loss ii) Minor loss iii) Hydraulic gradient line iv) Total energy line.	10	L2	CO4
		OR			
Q.8	a.	Find an expression for the velocity distribution for viscous flow between two parallel plates when both plates are fixed across a section is parabolic in nature.	10	L1	CO4
	b.	Show the maximum velocity in a circular pipe for a viscous flow is equal to two times the average velocity of the flow.	10	L2	CO4
		Module – 5			
Q.9	a.	Interpret the different types of similarities that must exist between a prototype and its model.	10	L3	CO5
	b.	The pressure difference Δp in a pipe of diameter D and length l and to viscous flow depends the velocity V, viscosity μ and density ρ. Using Buckingham's π - theorem, obtain an expression for Δp.	10	L4	CO5
		OR			
Q.10	a.	Derive the expression for the isothermal work done by a reciprocating compressor of single stage, neglecting clearance volume.	10	L3	CO5
	b.	A multistage compressor is to designed to elevate the pressure from 1 bar to 120 bar such that the stage pressure ratio will not exceed 4. Determine: i) Number of stages ii) Exact stage pressure ratio iii) Intermediate pressures iv) The minimum power required to compress $15m^3$/min of free air. Take n = 1.2.	10	L4	CO5

* * * * *