CBCS SCHEME - Make-Up Exam

USN | | | | | | | | | | |

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 terms with SI units: i) Mass density ii) Kinematic viscosity iii) Capillarity iv) Specific volume v) Compressibility of fluids	10	L2	CO1
	b.	Calculate the dynamic viscosity of an oil, which is used for lubrication between a square plate of size 0.8 m × 0.8 m and an inclined plane with an angle of inclination 30°. The weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s. The thickness of oil film is 1.5 mm.	10	L3	CO1
		OR			
Q.2	a.	Define: i) Absolute pressure ii) Gauge pressure iii) Vacuum pressure	6	L1	CO1
	b.	Derive an expression for the force exerted on a submerged vertical plane surface by the static liquid.	8	L2	CO5
	c.	The right limb of a simple U-tube manometer containing mercury is open to the atmosphere while the left limb is connected to a pipe in which a fluid of specific gravity 0.9 is flowing. The center of the pipe is 12 cm below the level of mercury in the right limb. Find the pressure of fluid in the pipe if the difference of mercury level in the two limbs is 20 cm.	6	L3	CO1
		Module – 2			
Q.3	a.	Define the terms buoyancy and centre of buoyancy.	4	L1	CO2
	b.	What are the conditions of equilibrium of a floating body and a submerged body?	6	L2	CO5
	c.	A solid cylinder of diameter 4 m has a height 4 m. Find the meta centric height of the cylinder if the specific gravity of the material of cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.	10	L3	CO2

		OR			
Q.4	**a.**	Distinguish between i) Steady flow and unsteady flow ii) Uniform and non uniform flow iii) Compressible and incompressible flow iv) Rotational and irrotational flow v) Laminar and turbulent flow	**10**	**L2**	**CO2**
	b.	The stream function for a two dimensional flow is given by $\psi = 2xy$. Calculate the velocity at the point P(2, 3). Find the velocity potential function ϕ.	**10**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive the Bernoulli's equation from Euler's equation for an incompressible frictionless fluid and state the assumptions made.	**10**	**L2**	**CO3**
	b.	A pipeline carrying oil of specific gravity 0.87, changes in diameter from 200 mm diameter at a position A to 500 mm diameter at a position B which is 4 m at a higher level. If the pressure at A and B are 9.81 N/cm^2 and 5.886 N/cm^2 respectively and the discharge is 200 litres/s. Determine the loss of head and direction of flow.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Define orificemeter. Prove that the discharge through an orifice meter is given by the relation $Q = c_d \frac{a_1 a_2 \sqrt{2gh}}{\sqrt{a_1^2 - a_2^2}}$ where a_1 – area of pipe a_2 – area of orifice	**10**	**L2**	**CO3**
	b.	Water flows over a rectangular weir 1m wide at a depth of 150 mm and afterwards passes through a triangular right angled weir. Taking c_d for the rectangular and triangular weir as 0.62 and 0.59 respectively. Find the depth over the triangular weir.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Derive Darcy-Weisbch equation for finding loss of head due to friction in pipes.	**10**	**L2**	**CO4**
	b.	The rate of flow of water through a horizontal pipe is 0.25 m^3/s. The diameter of the pipe which is 200 mm is suddenly enlarged to 400 mm. The pressure intensity in the smaller pipe is 11.772 N/cm^2. Determine: i) Loss of head due to sudden enlargement ii) Pressure intensity in the large pipe	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Derive Hagen-Poisauille equation for shear stress distribution and velocity distribution for the flow of viscous fluid through circular pipe.	**10**	**L2**	**CO4**

	b.	Water at 15°C flows between two large parallel plates at a distance of 1.6 mm apart. Determine : i) The maximum velocity ii) The pressure drop per unit length iii) The shear stress at the walls of the plates if the average velocity is 0.2 m/s Take viscosity of water at 15°C as 0.01 poise.	10	L3	CO4
		Module – 5			
Q.9	a.	Define similitude. Explain types of similarities.	10	L1	CO4
	b.	The frictional torque T of a disc of diameter D rotating at a speed N in a fluid of viscosity μ and density ρ in a turbulent flow is given by $T = D^5N^2e\ \phi\left[\frac{\mu}{D^2Ne}\right]$ Prove this by Buckingham's π theorem.	10	L3	CO4
		OR			
Q.10	a.	With neat sketch, explain the principle and working of a centrifugal pump.	10	L1	CO4
	b.	A single stage reciprocating air compressor is required to compress 1 kg of air from 1 bar to 4 bar. The initial temperature is 27°C. Compare the work requirement in the following cases : i) Isothermal compression ii) Isentropic compression	10	L3	CO4

* * * * *