CBCS SCHEME

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BAE/BAS303

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Fluid Mechanics

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.
3. Assume the suitable data if missing.

		Module – 1	**M**	**L**	**C**
Q.1	**a.**	Define the following: i) Mass density and specific gravity ii) Ideal fluid and Newtonian fluid iii) Dynamic viscosity and kinematic viscosity	6	L2	CO1
	b.	With a neat sketch derive an expression for capillary rise.	6	L3	CO1
	c.	Two large plane surfaces are 2.4 cm apart. The space between the surfaces is filled with glyceline. What force is required to drag a very thin plate of surface area 0.5 sq. metre between the two large plane surfaces at a speed of 0.6 m/s, if : i) The thin plate is in the middle of the two plane surfaces ii) The thin plate is at a distance of 0.8 cm from one of the plane surfaces? Take the dynamic viscosity of glycerine = 8.10×10^{-1} N-s/m^2.	8	L3	CO1
		OR			
Q.2	**a.**	Prove that pressure intensity at a point in static fluid is same in all direction.	8	L2	CO1
	b.	Explain the following with a neat sketch: i) Piezometer ii) U-tube manometer	8	L2	CO1
	c.	An open tank contains water upto a depth of 2 m and above it an oil of specific gravity 0.9 for a depth of 1 m. Find the pressure intensity i) at the interface of the two liquids and ii) at the bottom of the tank.	4	L3	CO1
		Module – 2			
Q.3	**a.**	Derive an expression for continuity equation for a three-dimensional flow in Cartesian co-ordinates.	10	L3	CO2
	b.	Water flows through a pipe AB1.2 m diameter at 3 m/s and then passes through a pipe BC1.5 m diameter. At C, the pipe branches, branch CD is 0.8 m in diameter and carries one third of the flow in AB. The flow velocity in branch CE is 2.5 m/s. Find the volume rate of flow in AB, the velocity in BC, the velocity in CD and the diameter of CE. Sketch the arrangement.	10	L3	CO2

		OR			
Q.4	**a.**	Obtain an integral form and differential form of energy equation using control volume approach.	**12**	**L2**	**CO2**
	b.	If for a two-dimensional potential flow, the velocity potential is given by $\phi = x(2y - 1)$. Determine the velocity at the point P(4, 5). Determine also the value of stream function ψ at the point P.	**8**	**L3**	**CO2**
		Module – 3			
Q.5	**a.**	Derive an expression for the discharge of fluid through orifice-meter.	**10**	**L3**	**CO3**
	b.	A non-uniform part of a pipe line 5 m long is laid at a slope of 2 in 5. Two pressure gauges each fitted at upper and lower ends read 20 N/cm^2 and 12.5 N/cm^2. If the diameters at the upper and lower ends are 15 cm and 10 cm respectively, determine the quantity of water flowing per second.	**10**	**L3**	**CO3**
		OR			
Q.6	**a.**	Using Buckingham's π-theorem, show that thrust P developed by a propeller is given by $P = D^2V^2\rho f\left[\frac{DW}{V}, \frac{\mu}{\rho VD}, \frac{C}{V}\right]$ where in W is angular velocity, V is speed of advance, μ is dynamic viscosity, ρ is mass density and C is elasticity of fluid medium denoted by speed of sound is medium.	**10**	**L3**	**CO3**
	b.	Derive an expression for all the dimensionless numbers.	**10**	**L2**	**CO3**
		Module – 4			
Q.7	**a.**	Define: i) Lift force ii) Drag force, with a neat sketch derive an expression for drag and lift force.	**10**	**L2**	**CO4**
	b.	A jet plane which weights 29.43 kN and having a wing area of 20 m^2 flies at a velocity of 950 km/hr, when the engine delivers 7357.5 kW power 65% of power is used to overcome the drag resistance of the wing. Calculate the co-efficients of lift and drag flow the wing. The density of the atmospheric air is 1.21 kg/m^3.	**10**	**L3**	**CO4**
		OR			
Q.8	**a.**	Derive an expression for a lift force on rotating cylinder which represents Kutta-Joukowski equation.	**12**	**L2**	**CO4**
	b.	Find displacement thickness, momentum thickness, energy thickness and δ^*/θ for velocity distribution in the boundary layer given by $\frac{u}{U} = \frac{y}{\delta}$ where u is velocity at distance y from plate and u = U at y = δ, where δ = boundary layer thickness.	**8**	**L3**	**CO4**

		Module – 5			
Q.9	**a.**	Derive Bernoulli's equation for i) Isothermal process ii) Adiabatic process in a steady compressible flow	**10**	**L3**	**CO5**
	b.	Define the following on the basis of Mach number for compressible flow, i) Sub-sonic flow ii) Sonic flow iii) Super-sonic flow	**5**	**L2**	**CO5**
	c.	Find the sonic velocity for the following fluids: i) Crude oil of specific gravity 0.8 and bulk modulus 153036 N/cm^2. ii) Mercury having a bulk modulus of 2648700 N/cm^2.	**5**	**L3**	**CO5**
		OR			
Q.10	**a.**	Derive the expression for stagnation pressure for a compressible fluid under adiabatic condition.	**10**	**L3**	**CO5**
	b.	Find the Mach number when an aeroplane is flying at 1100 km/hr through still air having a pressure of 7 N/cm^2 and temperature -5°C. Wind velocity may be taken as zero. Take R = 287.14 J/kg K. calculate the pressure, temperature and density of air at stagnation point on the nose of the plane. Take K = 1.4.	**10**	**L3**	**CO5**

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