



Fourth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026

Fluid Mechanics

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 properties fluid and mention their S.I. units. i) Mass density ii) Specific volume iii) Viscosity iv) Surface Tension v) Bulk modulus	10	L1,2	CO1
	b.	State and prove Pascals law.	10	L3	CO1
OR					
Q.2	a.	Distinguish between : i) Absolute pressure ii) Gauge pressure iii) Gauge vacuum iv) Atmospheric pressure. Indicate their relative position on a chart.	6	L2	CO1
	b.	A differential manometer is connected at the two points 'A' and 'B' as shown in Fig Q2(b). At 'B' air pressure is 9.81 N/cm^2 (abs). Find the absolute pressure at A. <div style="text-align: center;"> <p style="text-align: center;">Fig Q2(b)</p> </div>	6	L3	CO1
	c.	A tank contains water upto a height of 0.5 m above the base. An immiscible liquid of sp.gr 0.8 is filled on the top of water up to 1 m height. Calculate : i) Total pressure on one side of the tank ii) The position of centre of pressure for one side of the tank, which is 2m wide.	8	L3	CO1

Module – 2					
Q.3	a.	Define the following types of flow i) Steady and unsteady flow ii) Laminar and Turbulent flow iii) Compressible and Incompressible flow iv) Rotational and Irrotational flow v) One, Two and Three dimensional flows	10	L2	CO2
	b.	Derive the general three dimensional continuity equation in Cartesian coordinates and then reduce it to the continuity equation for steady, three dimensional incompressible flows.	10	L3	CO2
OR					
Q.4	a.	Derive an expression for the velocity distribution and shear stress distribution for the viscous flow through a circular pipe. Also sketch the velocity distribution and shear stress distribution across a section of the pipe.	8	L3	CO2
	b.	Define Reynolds number. Explain its significance in fluid flow.	4	L2	CO2
	c.	The velocity in a fluid flow is given by $V = 4x^3i - 10x^2yj + 2tK$. Find the velocity and acceleration of a fluid particle at (2, 1, 3) at time $t = 1$.	8	L3	CO2
Module – 3					
Q.5	a.	Derive Euler's equation of motion along a stream line, obtain Bernoulli's equation from Euler's equation. Mention the assumption made.	8	L3	CO3
	b.	Water is flowing through a pipe having dia 300 mm and 200 mm at the bottom and upper end respectively. The intensity of pressure at the bottom end is 24.523 N/cm^2 and the pressure at the upper end is 9.81 N/cm^2 . Determine the difference in datum head, if the rate of flow through the pipe is 40 l/t/sec .	6	L3	CO3
	c.	A pipe of 300 mm dia conveying $0.30 \text{ m}^3/\text{s}$ of water has a right angled bend in horizontal plane. Find the resultant force exerted on the bend, if the pressure at inlet and outlet of the bend are 24.525 N/cm^2 and 23.544 N/cm^2 .	6	L3	CO3
OR					
Q.6	a.	Derive Darcy –Weisbach equation for the loss of head due to friction in a pipe flow.	8	L3	CO3
	b.	Using impulse momentum equations derive the expression for the force exerted by the jet of fluid on a vane with the following cases. i) Flat fixed vane ii) Symmetrical fixed curved vane with the jet striking the vane at the centre.	6	L3	CO3
	c.	A crude oil of kinematic viscosity 0.4 stokes is flowing through a pipe of diameter 300 mm at the rate of 300 l/t per second. Find the head lost due to friction for a length of 50 m of the pipe.	6	L3	CO3

Module – 4					
Q.7	a.	Explain the following terms : i) Drag ii) Lift iii) Friction drag iv) Pressure drag.	8	L2	CO4
	b.	Water is flowing over a flat plate with a velocity of 3m/s. Find the distance from leading edge of the plate at which boundary layer approximately becomes turbulent. Also find the thickness of boundary layer at that location. Take $\nu = 1.12 \times 10^{-6} \text{ m}^2/\text{s}$ for water.	4	L3	CO4
	c.	For the following velocity profiles determine whether the flow has separated on the verge of separation or will attach with the surface. i) $\frac{u}{U} = \frac{3}{2}\left(\frac{y}{\delta}\right) - \frac{1}{2}\left(\frac{y}{\delta}\right)^3$ ii) $\frac{u}{U} = -2\left(\frac{y}{\delta}\right) + \left(\frac{y}{\delta}\right)^2$	8	L3	CO4
OR					
Q.8	a.	Define the following dimension less numbers i) Reynolds number ii) Froude's number iii) Euler's number iv) Weber's number v) Mach number.	10	L2	CO4
	b.	The resisting force 'R' of a supersonic plane during flight can be considered as dependent upon the length of the aircraft 'l', velocity V, air viscosity μ , air density ' ρ ' and Bulk modulus K. Express the functional relationship between these variable and resisting force. Use Buckingham's π theorem method.	10	L3	CO4
Module – 5					
Q.9	a.	Derive an expression for the velocity of a sound wave interms of change of pressure and change of density.	8	L3	CO5
	b.	Compute the velocity of a bullet fired in standard air if mach angle is 30° . Take $R = 0.28714 \text{ kJ/Kg}^\circ\text{K}$ and $K = 1.4$ for air. Assume temperature as 15°C .	6	L3	CO5
	c.	Compute the Mach number at a point on a jet propelled aircraft, which is flying at 1100 Km/hr at sea level. Where air temperature is 20°C . Take $K = 1.4$ and $R = 287 \text{ J/Kg}^\circ\text{K}$.	6	L3	CO5
OR					
Q.10	a.	Define the following and write the expressions i) Stagnation enthalpy ii) Stagnation temperature iii) Stagnation pressure iv) Stagnation density.	8	L2	CO5
	b.	What is CFD? Mention the applications and limitations.	6	L2	CO5
	c.	What are the steps involved in solving CFD problem? Explain.	6	L2	CO5
