CBCS SCHEME

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

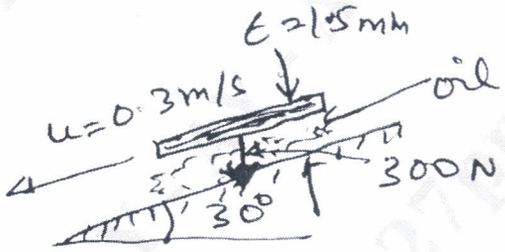
BAE303/BAS303

ACHARYA INSTITUTE OF TECHNOLOGY
MCA
Library
Date
BANGALORE

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
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 Suitable missing data.

		Module – 1	M	L	C
Q.1	a.	Define the following with their units i) Max density ii) Dynamic viscosity iii) Kinematic viscosity iv) Surface tension v) Specific gravity.	10	L1	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 on inclined plane with an angle of inclination 30° as shown in the Fig Q1(b), weight of the square plate is 300 N and it slides down the inclined plane with a uniform velocity of 0.3 m/s thickness of oil film is 1.5 mm.  Fig Q1(b)	10	L3	CO1
		OR			
Q.2	a.	Prove : i) Pascal's law of pressure ii) Hydrostatic law.	10	L2	CO2
	b.	A rectangular plane surface is 2 m wide and 3m deep. It lies in the vertical plane in water. Determine the total pressure and position of center of pressure when its upper edge is horizontal and i) Coincides with water surface ii) 2.5 m below the free water surface.	10	L3	CO2
		Module – 2			
Q.3	a.	Derive continuity equation in 3 Dimensions.	10	L2	CO2
	b.	The velocity potential function is given by $\phi = 5(x^2 - y^2)$. Calculate the velocity components at the point (4, 5).	10	L3	CO2
		OR			
Q.4	a.	Derive Integral form of energy equation.	10	L3	CO1
	b.	Define and explain : i) Source ii) Sink iii) Doublet iv) Stream function v) Potential function.	10	L3	CO1

		Module – 3			
Q.5	**a.**	Derive Bernoulli's equation form first principles and state the assumptions made.	**10**	**L1**	**CO2**
	b.	An orifice meter with orifice diameter 10 cm is inserted in a pipe of 20 cm diameter. The pressure gauges fitted upstream and downstream of the orifice meter give readings 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.	**10**	**L4**	**CO2**
		OR			
Q.6	**a.**	What are the various similarities exist between model and prototype. Explain.	**10**	**L2**	**CO3**
	b.	The pressure difference ΔP in a pipe of diameter D and length 'ℓ' due to turbulent flow depend on velocity V, viscosity μ, density ρ and roughness K. Using Buckingham's π-theorem obtain the expression for ΔP.	**10**	**L3**	**CO3**
		Module – 4			
Q.7	**a.**	Derive Von-Karman momentum Integral equation for boundary layer flows.	**10**	**L1**	**CO3**
	b.	The velocity distribution in the boundary layer over a high spillway surface was found to be $\frac{u}{U_o}=\left(\frac{y}{\delta}\right)^{0.22}$. Express the ratio between momentum thickness θ and displacement thickness δ^*.	**10**	**L3**	**CO3**
		OR			
Q.8	**a.**	What is lift and drag? Derive them.	**10**	**L2**	**CO3**
	b.	A kite has an effective area of $0.4m^2$ and weight 2N. In a wind of 40 Km/hr, the drag on the kite is 11.9 N. Determine the tension in the chord is the cord makes an angle of 45° with horizontal. Also determine the lift coefficient.	**10**	**L4**	**CO2**
		Module – 5			
Q.9	**a.**	Derive Bernoulli's equation for i) Isothermal process ii) Adiabatic process.	**10**	**L1**	**CO2**
	b.	A gas with a velocity of 300 m/s is flowing through a horizontal pipe at a section where pressure 6×10^4 N/m^2 (absolute) and temperature 40°C. The pipe charges in diameter and this section pressure is 9×10^4 N/m^2. Find the velocity of gas at this section if the flow is adiabatic.	**10**	**L4**	**CO2**
		OR			
Q.10	**a.**	Find an expression for velocity of sound wave in a fluid.	**10**	**L3**	**CO2**
	b.	Calculate the stagnation pressure, temperature, density on the stagnation point on the nose of a plane, which is flying at 800 Km/hr through still air having a pressure 8.0 N/cm^2 (abs) and temperature (-10°C). Take R = 2875/Kg K and K = 1.4.	**10**	**L4**	**CO2**

* * * * *