Roll No. | | | | | | | | | | |

ANNA UNIVERSITY (UNIVERSITY DEPARTMENTS)

B.E. /B.Tech / B. Arch (Full Time) - END SEMESTER EXAMINATIONS, NOV / DEC 2024

CIVIL ENGINEERING

CE 5351 & Fluid Mechanics
(Regulation2019)

Time:3hrs

Max.Marks: 100

CO1	Demonstrate the difference between solid and fluid, its properties and behaviour in static conditions
CO2	Apply the conservation laws applicable to fluids and its application through fluid kinematics and dynamics
CO3	Formulate the relationship among the parameters involved in the given fluid phenomenon and to predict the performances of prototype by model studies.
CO4	Estimate losses in pipelines for both laminar and turbulent conditions and analysis of pipes connected in series and parallel
CO5	Explain the concept of boundary layer and its application to find the drag force excreted by the fluid on the flat solid surface.

BL – Bloom's Taxonomy Levels
(L1-Remembering, L2-Understanding, L3-Applying, L4-Analysing, L5-Evaluating, L6-Creating)

PART- A(10x2=20Marks)
(Answer all Questions)

Q.No.	Questions	Marks	CO	BL
1	Define Mass Density.	2	1	1
2	Define Meta centric height.	2	1	1
3	Write the importance of stream function.	2	2	2
4	List the assumptions made in deriving Darcy's equation.	2	2	1
5	Give one example for Dimensional homogeneity.	2	3	2
6	Define scale ratio.	2	3	1
7	Differentiate between Laminar and Turbulent flow.	2	4	2
8	Define Vena contracta.	2	4	1
9	List out the conditions for separation of boundary layer.	2	5	2
10	Differentiate the drag force from a lift force?	2	5	2

PART- B(5x 13=65Marks)

Q.No.	Questions	Marks	CO	BL
11 (a)	A circular plate 2.5m diameter is immersed in water, its greatest and least depth below the free surface being 3m and 1m respectively. Determine (a) the total pressure on one face of the plate and (b) the position of the centre of pressure.	13	1	3
	OR			
11(b)	(i) A plate 0.0254mm distant from a fixed plate, moves at 61cm/s and requires a force of 0.2kgf/m^2 to maintain this speed. Determine the dynamic viscosity of the fluid between the plates. (ii) Calculate the capillary effect in mm in a glass tube 3mm in diameter when immersed in (a) water and (b) mercury. Both the liquids are at 20°C and the values of the surface tensions for water and mercury at 20°C in contact with air are respectively 0.0736 N/m	13	1	3

	and 0.51 N/m. Contact angle for water and mercury are 0° and 130° respectively.			
12 (a)	A bend in pipeline conveying water gradually reduces from 0.6 m to 0.3 m diameter and deflects the flow through angle of 60°. At the larger end the gauge pressure is 171.675 kN/m^2. Determine the magnitude and direction of the force exerted on the bend (a) when there is no flow, (b) when the flow is 876 litres/s.	**13**	2	3
	OR			
12 (b)	(i) Derive the Bernoulli's equation and give the assumptions made in it. (ii) A pipe 300 m long has a slope of 1 in 100 and tapers from 1.2 m diameter at the high end to 0.6 m diameter at the low end. Quantity of water flowing is 5400 liters per minute. If the pressure at the high end is 68.67 kPa, Calculate the pressure at the low end. Neglect losses.	**6** **7**	2	3
13 (a)	Using the Buckingham's π theorem, Prove that the discharge (Q) consumed by an oil ring is given by $Q = N(d)^3\phi[\frac{\mu}{\rho N(d)^2}, \frac{\sigma}{\rho(N)^2(d)^3}, \frac{w}{\rho(N)^2 d}]$. Where d is the internal diameter of the ring, N is rotational speed, ρ is density, μ is viscosity, σ is surface tension and w is specific weight of oil.	**13**	3	3
	OR			
13 (b)	A shallow river is 1500m wide and the maximum depth of flow in it is 5m. It carries a discharge of 3000m^3/s, the velocity of flow being 1.5m/s. The model of river is constructed to the horizontal scale of 1:800 and the vertical scale of 1:40. If Manning's 'n' for the bed material in the river is 0.025, find the value of 'n' for the bed material of the model. The hydraulic mean depth may be assumed to be equal to mean depth of flow.	**13**	3	3
14 (a)	The difference in water surface levels in two tanks, which are connected by three pipes in series of lengths 300 m, 170 m and 210m and of diameters 300mm, 200 mm and 400 mm respectively, is 12m. Estimate the rate of flow of water if co – efficient of friction are 0.005, 0.0052 and 0.0048 respectively, considering minor losses also.	**13**	4	4
	OR			
14 (b)	A pipe of 50mm diameter is 6m long and the velocity of flow of water in the pipe is 2.4m/s. What loss of head and the corresponding power would be saved if the central 2m length of pipe was replaced by 75mm diameter pipe, the change of section being sudden? Take f=0.04 for the pipes of both diameters.	**13**	4	4
15 (a)	Determine the displacement thickness, the momentum thickness and energy thickness for the velocity distribution in the boundary layer given by $(u/U) = 2(y/\delta) - (y/\delta)^2$.	**13**	5	3
	OR			
15 (b)	Derive the Von Karman momentum integral equation.	**13**	5	3

PART- C(1x 15=15Marks)

(Q.No.16 is compulsory)

Q.No.	Questions	Marks	CO	BL
16.	For the distribution main of a city water supply a 0.3m main is required. As pipes above 0.25m diameter are not available, it is decided to lay two parallel main of same diameter. Design the diameter of the parallel main.	**15**	4	5