Reg. No.															

Question Paper Code	12887

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2024

Third Semester

Civil Engineering

20CEPC303 - FLUID MECHANICS

Regulations - 2020

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

		Marks	K – Level	CO
1.	What are real fluids? Give example.	2	K1	CO1
2.	List out the phenomenon responsible for capillary rise or capillary fall.	2	K1	CO1
3.	What are convective and local acceleration?	2	K1	CO3
4.	Write any two properties of flow net.	2	K1	CO3
5.	State and define Buckingham's π theorem.	2	K1	CO4
6.	What do you mean by dimensionless number? Name any four dimensionless numbers.	2	K1	CO4
7.	Sketch the shear stress and velocity distribution for laminar flow between two parallel plates.	2	K2	CO5
8.	What are the major and minor energy losses in a pipe line?	2	K1	CO5
9.	Define boundary layer thickness.	2	K1	CO6
10.	What is known as boundary layer separation?	2	K1	CO6

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a) i)	One litre of crude oil weighs 7N. Calculate it's density, specific weight and specific gravity.	7	K3	CO1
	ii)	A plate 0.025 mm distant from a fixed plate, moves at 50 cm/s and requires a force of 1.471 N to maintain this speed. Determine the fluid viscosity.	6	K3	CO1
		OR			
	b) i)	When a dolphin glides through air, it experiences an external pressure of 1m of mercury. Find the absolute pressure on dolphin, if it is 5m below the surface of water.	5	K3	CO1
	ii)	Calculate the capillary effect in a glass tube of 2.5mm diameter, when immersed in water and mercury. Take σ_w = 0.0725 N/m and σm = 0.52 N/m in contact with air. The contact angle for water θ = 0°C and for mercury θ = 130°C.	8	K3	CO1

12. a) Water flows through a pipe AB 1.2m diameter at 3m/s and then passes through a pipe BC 1.5m in diameter. At C the pipe branches. Branch CD is 0.8m in diameter and carries one third of flow in AB. The flow velocity in branch CE is 2.5m/s. Find the volume rate of flow in AB, velocity in BC, CD and diameter of CE. *13 K3 CO3*

OR

b) A pipe line carrying oil of specific gravity 0.87, changes in diameter from 200mm at position A to 500mm at position B, which is 4m at higher level. If the pressures at A and B are 9.81 N/cm^{2}and 5.886 N/cm^2 respectively and the discharge is 200lps. Determine the loss of head and direction of flow. *13 K3 CO3*

13. a) Using Buckingham's π theorem, show that the velocity through a circular orifice is given by $v = \sqrt{2gh}\varphi(\frac{D}{H}, \frac{\mu}{\rho vH})$ where H is the head causing flow, D is the diameter of the orifice, μ is the coefficient of viscosity, ρ is the mass density and g is the acceleration due to gravity. *13 K3 CO4*

OR

b) A 7.2m high and 15m long spillway discharges 94m^3/s under a head of 2m. If 1:9 scale model of spillway is to be constructed. Determine the model dimensions, head over spillway model and the model discharge. If model experiences a force of 7500 N, determine the forces on the prototype. *13 K3 CO4*

14. a) Determine the loss of head due to friction in a pipe of diameter 400mm and length 100m through which water is flowing at a velocity of 2.5m/s by using a) Darcy Weisbach formula and b) Chezy's formula for which C=60. Take kinematic viscosity of water as 0.01 stokes. *13 K3 CO5*

OR

b) The difference in water surface level in two tanks which are connected by three pipes in series of length 300m, 170m and 210m and of diameters 300mm, 200mm and 400mm respectively is 12m. Determine the rate of flow of water, if co-efficient of friction are 0.005, 0.0052 and 0.0048m respectively. Considering minor losses also. *13 K3 CO5*

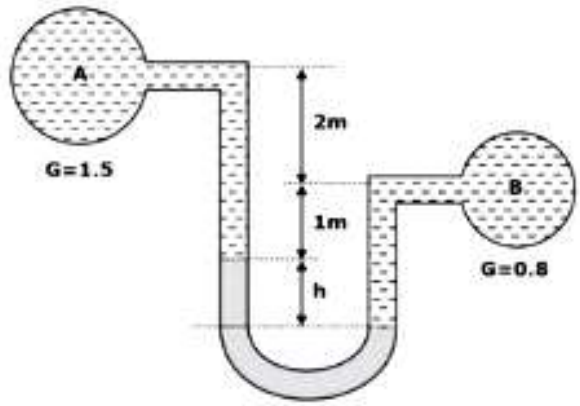
15. a) A plate moves at 50kmph of 1.5m x 1.5m in stationary air of density 1.15kg/m^3, if the coefficient of drag and lift are 0.15 and 0.75 respectively. Determine: (i) Lift force (ii) Drag force (iii) Resultant force (iv) Power required to keep the plate in motion. *13 K3 CO6*

OR

b) Calculate (i) the displacement thickness (ii) the momentum thickness and (iii) the energy thickness in a boundary layer over the face of a high spillway for which the velocity distribution is $\boldsymbol{u / U = y / \delta}$. *13 K3 CO6*

PART - C (1 × 15 = 15 Marks)

16. a) A differential manometer is connected to two pipes A and B as shown in figure. Pipe A and B contain the liquids of specific gravity 1.5 and 0.8 respectively and pressure at A and B are 50kPa and 120kPa respectively. Find the difference in mercury level in the differential manometer. *15 K3 CO2*



OR

b) A circular plate of 4m diameter is immersed in water in such a way that its greatest depth and least depth below the free surface are 6m and 3m respectively. Find the total pressure on the face of the plate and position of center of pressure. *15 K3 CO2*