Reg. No.												

Question Paper Code	12424

B.E. / B.Tech. - DEGREE EXAMINATIONS, NOV / DEC 2023

Third Semester

Civil Engineering

20CEPCE303 - FLUID MECHANICS

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

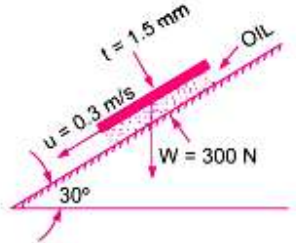
Answer ALL Questions

		Marks, K-Level, CO
1.	State Newton's Law of viscosity.	*2,K1,CO1*
2.	Define surface tension and capillarity.	*2,K1,CO1*
3.	Why do we use mercury in the manometer while measuring the pressure of fluids?	*2,K2,CO2*
4.	What is meant by total pressure and center of pressure?	*2,K1,CO2*
5.	The velocity in m/s at a point in a two-dimensional flow is given as V=2i+3j. Find the equation of streamline passing through the point.	*2,K2,CO3*
6.	State impulse momentum equation.	*2,K1,CO3*
7.	State the principle of dimensional homogeneity.	*2,K1,CO4*
8.	Define scale ratio.	*2,K1,CO4*
9.	Give four examples in everyday life, where formation of boundary layer is important.	*2,K2,CO6*
10.	Define the term drag and lift.	*2,K1,CO6*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	Calculate the dynamic viscosity of oil which is used for lubrication between a square plate of size 800mm × 800mm and an inclined plane with angle of inclination 30°. The weight of the square plate is 330N and it slides down the inclined plane with uniform velocity of 300mm/s. Thickness of the oil film is 1.5mm.	*13,K2,CO1*

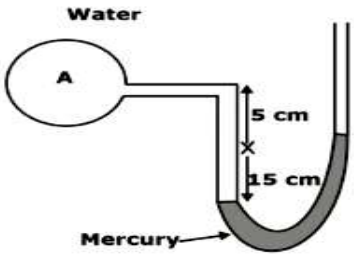


OR

b) A 150mm diameter vertical cylinder rotates concentrically inside another cylinder of diameter 151mm. Both cylinders are 250mm high. The space between the cylinders is filled with a liquid whose viscosity is unknown. If a torque of 12 Nm is required to rotate the inner cylinder at 100 rpm. Determine the viscosity of the fluid. *13,K2,CO1*

12. a) (i) State and prove Pascal's law. *5,K2,CO2*

(ii) A manometer is attached to the water flowing duct as shown. Calculate the pressure at point A. *8,K2,CO2*



OR

b) Derive an expression for depth of center of pressure from the free surface of liquid of an inclined plane surface submerged in the liquid. *13,K2,CO2*

13. a) The following cases represent the velocity components, determine the third component of velocity, such that they satisfy the continuity equation

(i) $u = x^2 + y^2 + z^2; v = xy^2 - yz^2 + xy$ *7,K2,C03*

(ii) $v = 2y^2;\ w = 2xyz$ *6,K2,C03*

OR

b) A horizontal venturimeter with inlet diameter 250mm and throat diameter 120mm is used to measure the flow of oil of specific gravity 0.85. The discharge of oil through the venturimeter is 80lps. Find the reading of oil-mercury differential manometer. Take $C_d = 0.97$. *13,K2,CO3*

14. a) A partially submerged body is towed in water. Assuming that the resistance R to the motion depends on the density ρ, the length of the body l, the velocity of the body v, the viscosity μ and the acceleration due to gravity g. Show that the resistance R is given by *13,K3,CO4*

$$R = \rho l^2 v^2 \varphi\left(\frac{\mu}{\rho v l}, \frac{lg}{v^2}\right).$$

OR

b) What are the different forces acting in a moving fluid? Also discuss different similarity model laws used to study the dynamic similarity of a prototype. *13,K2,CO4*

15. a) Prove that the momentum thickness and energy thickness for boundary layer flow are given by *13,K2,CO6*

$$\theta = \int_0^{\delta} \frac{u}{U}\left[1 - \frac{u}{U}\right] dy \quad \text{and} \quad \delta^{**} = \int_0^{\delta} \frac{u}{U}\left[1 - \frac{u^2}{U}\right] dy$$

OR

b) Derive an expression for the Vonkarman momentum integral equation for the boundary layer. *13,K2,CO6*

PART - C (1 × 15 = 15 Marks)

16. a) Derive Hagen – Poiseulle's equation for viscous flow through a circular pipe. *15,K3,CO5*

OR

b) Derive an expression for loss of head due to friction in a pipe flow. *15,K3,CO5*