20 JUN 2023

Reg. No.												

Question Paper Code	12056

B.E. / B.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2023

Third Semester

Civil Engineering

20CEPC303 - FLUID MECHANICS

(Regulations 2020)

Duration: 3 Hours | Max. Marks: 100

PART - A (10 × 2 = 20 Marks)

Answer ALL Questions

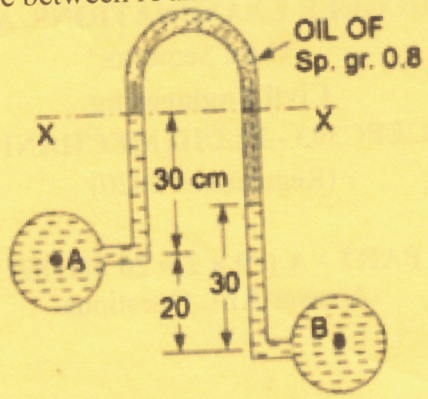
		Marks, K-Level, CO
1.	Write down the effect of temperature on viscosity of liquids and gases.	*2,K2,CO1*
2.	Say True or False. Surface tension of the fluid decreases with increases in temperature. Justify.	*2,K2,CO1*
3.	Why do we use mercury in the manometer while measuring the pressure of fluids?	*2,K2,CO2*
4.	Briefly explain the terms center of buoyancy and metacenter.	*2,K2,CO2*
5.	What are convective and local acceleration?	*2,K1,CO3*
6.	Define Bernoulli's equation and its applications.	*2,K1,CO3*
7.	State any two uses of dimensional analysis in the study of fluid mechanics.	*2,K1,CO4*
8.	Distinguish between distorted and undistorted models.	*2,K2,CO4*
9.	Sketch the shear stress and velocity distribution for laminar flow across a pipe section.	*2,K2,CO5*
10.	Write the formula for calculating the head loss due to (i) sudden enlargement and (ii) sudden contraction.	*2,K1,CO5*

PART - B (5 × 13 = 65 Marks)

Answer ALL Questions

11.	a)	If the velocity distribution of a fluid over a plate is given by $u = ay^2 + by + c$, with the vertex 0.2m from the plate, where the velocity is 1.2m/s and shear stress = 0. Calculate the velocity gradient and shear stresses at a distance of 0, 0.1 and 0.2m from the plate, if the viscosity of the fluid is 0.85 Ns/m^2.	*13,K3,CO1*
		OR	
	b)	A 400mm diameter shaft is rotating at 200 rpm in a bearing length of 120mm. If the thickness of the oil film is 1.5mm and dynamic viscosity of the oil is 7 poise. Determine i) Torque required to overcome friction in bearing ii) Power utilized in overcoming friction resistance. Assume a linear velocity profile.	*13,K3,CO1*

12. a) An inverted U-tube manometer is connected to two pipes A and B which conveys water. The fluid in the manometer is of oil of specific gravity 0.8. For the manometer reading shown in figure. Find the pressure difference between A and B. *13,K3,CO2*



OR

b) (i) Write short notes on manometers. *5,K2,CO2*
(ii) Discuss the applications of hydrostatic law. *8,K2,CO2*

13. a) The velocity components in a two dimensional incompressible flow are given by $u = y^3 + 6x - 3x^2y$ and $v = 3xy^2 - 6y - x^3$. Check the flow is continuous and irrotational. If the flow is irrotational, find the potential function and stream function at the point (1, 2). *13,K3,CO3*

OR

b) A 20 cm × 10 cm venturimeter is inserted into a vertical pipe carrying oil of specific gravity 0.8; the flow of oil is in upward direction. The difference of levels between throat and inlet section is 50cm. The oil-mercury differential manometers give a reading of 30cm of mercury. Find the (a) Discharge of oil and (b) Pressure difference between entrance and throat section. *13,K3,CO3*

14. a) By dimensional analysis, show that the torque T on a shaft of diameter D, revolving at a speed N in a fluid of viscosity μ and mass density ρ is given by the expression. *13,K3,CO4*

$$T = D^5N^2\rho\varphi\left[\frac{\mu}{D^2N\rho}\right]$$

OR

b) A ship 300m long moves in seawater, whose density is 1030 kg/m^3. A 1:100 model of this ship is to be tested in wind tunnel. The velocity of the air in the wind tunnel around the model is 30m/s and the resistance of the model is 60N. Determine the velocity of ship in sea water and also the resistance of the ship in seawater. The density of air is given as 1.24kg/m^3. Take the kinematic viscosity of seawater and air as 0.012 stokes and 0.018 stokes respectively. *13,K3,CO*

15. a) Determine :- *13,K3,CO5*

(i) Reynolds number of flow,
(ii) Centre line of velocity,
(iii) Wall shear stress,
(iv) Power required maintaining the flow.

For an oil of viscosity 1 poise and specific gravity 0.8 is flowing through 50mm diameter pipe of length 500m at a rate 1.9liters/sec.

OR

b) A crude oil of viscosity 0.97 poise and relative density 0.9 is flowing through a horizontal circular pipe of diameter 100mm and of length 10m. Calculate the difference of pressures at the two ends of the pipe, if 100 kg of oil is collected in a tank in 30 seconds. *13,K3,CO5*

PART - C (1 × 15 = 15 Marks)

16. a) Calculate (i) the displacement thickness (ii) the momentum thickness in a boundary layer over the face of a high spillway for which the velocity distribution is $\frac{u}{U} = 2\frac{y}{\delta} - \left(\frac{y}{\delta}\right)^2$. *15,K3,CO6*

OR

b) A thin plate is moving in still atmosphere air at a velocity 5m/s. the length of the plate is 0.6m and width is 0.5m. Show that boundary layer is laminar over the plate. Also calculate the thickness of the boundary layer at the end of the plate and drag force on one side of the plate. Take density of air as 1.24 kg/m^3 and kinematic viscosity as 0.15×10^{-4} m^2/sec. *15,K3,CO6*