Register Number:……..

KUMARAGURU
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B.E. DEGREE EXAMINATIONS: NOV/DEC 2023

(Regulation 2018)

Third Semester

CIVIL ENGINEERING

U18CET3104**:** Fluid Mechanics

COURSE OUTCOMES

CO1: Measure the pressure of a fluid flow and fluid pressure on a plane and curved surface.

CO2: Analyse the stability of floating and submerged bodies.

CO3: Apply the working concepts of various devices used to measure the velocity and discharge of fluid.

CO4: Analyse a pipe network.

CO5: Understand the kinematics that exists in the fluid flow and draw flow net.

CO6: Formulate the functional relationships that exist between dependent and independent variables of fluid flow.

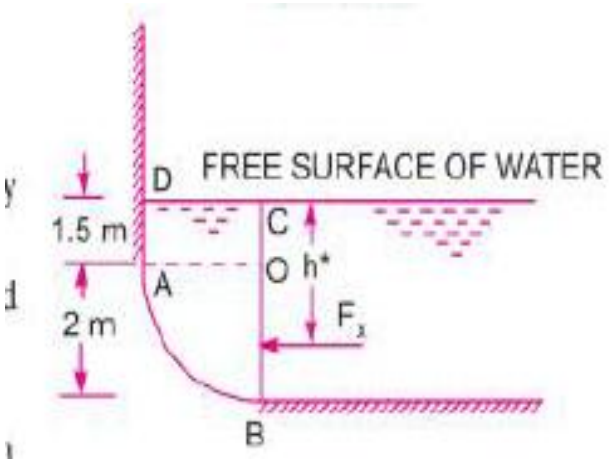
Time: Three Hours **Maximum Marks: 100**

Answer all the Questions:-
PART A (10 x 2 = 20 Marks)
(Answer not more than 40 words)

1.	Calculate the density, specific weight and Weight of one litre of petrol of specific gravity = 0.7	CO1	[K_3]
2.	What is a differential Manometer?	CO1	[K_1]
3.	Define meta-centric height.	CO2	[K_1]
4.	Summarize the conditions of stability of floating bodies.	CO2	[K_2]
5.	Write the assumptions considered for deriving the Bernoulli's equation.	CO3	[K_1]
6.	A pitot static tube is used to measure the velocity of water in a pipe. The Stagnation pressure head is 6m and static pressure head is 5 m. Calculate the velocity of flow assuming the co-efficient of tube equal to 0.98.	CO3	[K_3]
7.	How will you determine the loss of head due to friction in pipes by using Darcy Weisbach Formula?	CO4	[K_2]
8.	Distinguish between Steady flow and Unsteady flow.	CO5	[K_2]
9.	Differentiate between forced vortex and free vortex flow.	CO5	[K_2]
10.	What is meant by geometric similarity and dynamic similarity?	CO6	[K_2]

Answer any FIVE Questions:-
PART B (5 x 16 = 80 Marks)
(Answer not more than 400 words)

11.	a)	Compute the horizontal and vertical components of the total force acting on a curved surface AB, which is in the form of a quadrant of a circle 2 m as shown in figure. Take the width of the gate as unity.	8	CO1	[K3]



	b)	A U-tube manometer is used to measure the pressure of water in a pipeline, which is in excess of atmospheric pressure. The right limb of the manometer contains mercury and is open to atmosphere. The contact between water and mercury is in the left limb, Determine the pressure of water in the main line, if the difference in level of mercury in the limbs of U-tube is 10 cm and the free surface if mercury is in level with the center of the pipe. If the pressure of water in pipeline is reduced to 9810 N/m^2, calculate the new difference in the level of mercury.	8	CO1	[K3]
12.	a)	A ship 60 m long and 12 m broad has a displacement of 19620 kN. A weight of 294.3 kN is moved across the deck through a distance of 6.5 m. The ship is tilted through 5º. The moment of inertia of the ship at water line about its fore and after axis is 75% of the moment of inertia of the circumscribing rectangle. The center of buoyancy is 2.75 m below the water line. Find the meta-centric height and position of center of gravity of ship. Take specific weight of sea water as 10.104 kN/m^3.	8	CO2	[K3]
	b)	A solid cylinder of diameter 4 m has a height of 4.0 m. Find the meta-centric height of the cylinder if the specific gravity if the material of cylinder is 0.6 and it is floating in water with its axis vertical. State whether the equilibrium is stable or unstable.	8	CO2	[K3]

13.	a)	The inlet and throat diameters of a horizontal venturimeter are 30 cm and 10 cm respectively. The liquid flowing through the meter is water. The pressure intensity at inlet is 13.734 N/ cm^2 while the vacuum pressure head at the throat is 37 cm of mercury. Find the rate of flow. Assume that 4 % if the differential head is lost between the inlet and throat. Fina also the value of C_d for the venturimeter.	8	CO3	[K_3]
	b)	Find the discharge of water flowing through a pipe 30 cm diameter placed in an inclined position where a ventuirmeter is inserted, having a throat diameter of 15 cm. The difference of pressure between the main and throat is measured by a liquid of sp.gr 0.6 in an inverted U-tube which gives a reading of 30 cm. The loss of head between the main and throat is 0.2 times the kinetic head of the pipe.	8	CO3	[K_3]
14.	a)	A horizontal pipeline 40 m long is connected to a water tank at one end and discharges freely into the atmosphere at the other end. For the first 2 m of its length from the tank, the pipe is 150 mm diameter and its diameter is suddenly enlarged to 300 mm. The height of the water level in the tank is 8 m above the center of the pipe. Considering all the losses of head which occur, determine the rate of flow. Take f= 0.01 for both the sections of the pipe.	8	CO4	[K_3]
	b)	A pipeline of 0.6 m diameter is 1.5 m long. To increase the discharge, another line of the same diameter is introduced parallel to the first in the second half of the length. Neglecting minor losses, find the increase in discharge if 4f = 0.04. The head at inlet is 300 mm.	8	CO4	[K_3]
15.	a)	A 40cm diameter pipe, conveying water branches into two pipes of diameters 30 cm and 20 cm respectively, If the average velocity in the 40 cm diameter pipe is 3 m/s. Find the discharge in this pipe. Also determine the velocity in 20 cm pipe if the average velocity in 30 cm pipe is 2m/s.	8	CO5	[K_3]
	b)	A fluid flow field is given by $V = x^2yi + y^2zj - (2xyz + yz^2)k$. Prove that it is a case of possible steady incompressible fluid flow. Calculate the Velocity and acceleration at the point (2,1,3).	8	CO5	[K_3]
16.	a)	The efficiency ŋ of a fan depends on density ρ, dynamic viscosity μ of the fluid, angular velocity ω , diameter D of the rotor and the discharge Q. Express ŋ in terms of dimensionless parameter.	8	CO6	[K_3]

b) The pressure difference ΔP in a pipe of diameter D and length l due to turbulent flow depends on the velocity V, Viscosity μ, density ρ and roughness k. Using Buckingham's π- theorem, obtain an expression for ΔP.
(Take the Dimension of k as L). 8 CO6 [K_3]

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